

NUTS & VOLTS

M A G A Z I N E



\$3.50
VOL. 17 NO. 3
MARCH 1996

Exploring Electronics And Technology For The Hobbyist And Professional



Real-World Power For The BS2!

*Data Collection Proto Board
For The Stamp II Computer
Adds Analog Input, 32K Storage,
And Real-Time Clock*



Tucker Electronics

Your Full Service Dealer Is Now An Authorized **Tektronix** Distributor

The New TDS 300 Series Digital Real Time Oscilloscopes offer more scope for your money!

NEW



Capture real-time signals on each and every sweep with the new TDS 300 Series Digital Real Time Oscilloscopes — with twice the bandwidth and twice the sample rate of previous TDS 300 models. All models come with Fast Fourier Transform (FFT) to display harmonic content of waveforms. In addition, the TDS 360 and 380 come with a built-in floppy disk drive for simplified PC compatibility. These digital scopes will meet your needs in all areas: education, product design, manufacturing, service and troubleshooting.

CALL FOR PRICING AND AVAILABILITY

TekDMM™ Digital Multimeters are designed to fit your needs — and budget



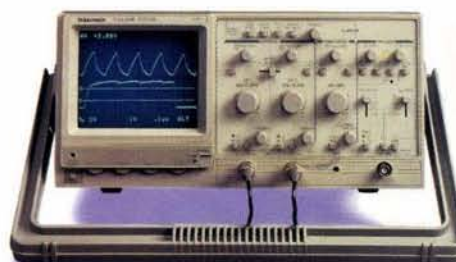
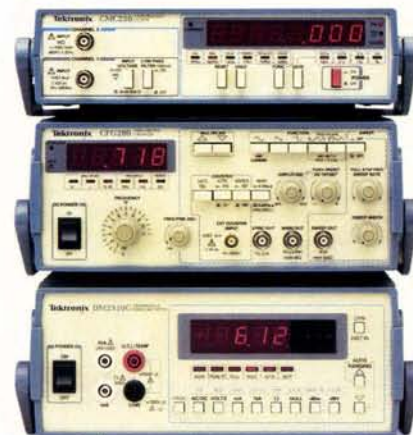
Compact, rugged and autoranging, this line of DMMs gives you Tektronix performance and reliability — in the field, at home or at the bench. When your work demands include troubleshooting electronics circuitry, adjusting and calibrating products, and checking components, our full line of DMMs offers the measurement capabilities to solve your problems. TekDMM features range from AC and DC volts and current to resistance and frequency. All TekDMMs come with a three-year warranty.

Counters, Multimeters & Function Generators Tektronix safety, measurement accuracy and reliability

Our **frequency counters** fit every application with a variety of price and performance levels.

Choose from among several **digital multimeters** to suit your needs, whether you'll benefit most from an inexpensive classroom model or from one of a series of programmable instruments that operate independently under computer control.

Our **function generators** are ideal for producing sine, square and triangle waves and TTL signals for testing amplifiers, filters and circuits. These instruments allow you to control duty cycle, DC offset, sweep rate, width and amplitude.



TAS 220 & TAS 250 Analog Oscilloscopes

When you need full analog features on a limited budget, the TAS 220 and TAS 250 are your answers. An ideal balance of features and cost yields real value for your business.

FULL SERVICE • FULL SERVICE • FULL SERVICE • FULL SERVICE • FULL SERVICE • FULL SERVICE • FULL SERVICE

For Full Service, Look No Further Than Tucker Electronics!

**NEW
TEST EQUIPMENT,
RADIO EQUIPMENT
AND
PROFESSIONAL TOOLS**

**PRE-OWNED
TEST EQUIPMENT,
RADIO EQUIPMENT
AND
HOBBYIST EQUIPMENT**

**WE BUY & TRADE
TEST EQUIPMENT,
RADIO EQUIPMENT
AND
HOBBYIST EQUIPMENT**

**QUALITY
REPAIR AND
CALIBRATION
SERVICES — FAST
& DEPENDABLE**

OPTOELECTRONICS GoldStar EXTECH BK PRECISION LEADER Protek WAVETEK HAMEG



Call, Write or Fax for Your Choice of FREE Catalogs...Radios, Scanners & Hobbyist Products or Test Equipment or Both...The Choice Is Yours!

Call: 800-527-4642 • Radio Hotline: 800-559-7388



1717 Reserve Street
Garland, TX
75042
Local Call
214-348-8800



TUCKER
ELECTRONICS



P.O. Box 551419
Dallas, TX
75355-1419
24-Hour Fax
214-348-0367

HSC Electronic Supply

Serving
Silicon Valley
since 1964!

...brings you a potpourri of high-tech goodies for the techno-tinkerer!
For thirty years we have been your source for Silicon Valley exotica!

Multimedia Kit to Go!

- Media Vision **Reno** External CD ROM/Audio CD Drive:
 - Consists of new external Reno CD-ROM drive, docking bay with SCSI2 port, AC Adapter
 - Double-speed 180ms drive is lightning fast!
 - Drive detaches from docking bay, use with headphones as a portable personal audio CD player
 - Great for Mac or IBM (adaptor bracket included)
 - Brand new in box, 90-day warranty

Media Vision Reno Kit HSC#15586

\$89.95



- Media Vision **Reno** Kit HSC#15586 includes:
- A. Rechargeable Battery Pack
 - B. Reno Cable Kit (SCSI2 - DB25 cable, 50p. ribbon cable, internal & external audio patch cables)
 - C. Padded Travel Pouch
 - D. Internal SCSI IDS50 to DB25 Adapter bracket for IBM, use with Reno cable kit (above) & your SCSI card for convenient SCSI and audio connections
 - E. Headphones (not shown)



F. Macintosh Powerbook SCSI Adapter (HDI-30 to 25-pin D connector) HSC#15704 \$12.50 if purchased alone, or with purchase of Reno Kit, \$5.00

Plug & Play Multimedia!

- Media Vision **Memphis** Kit (Limited Quantities Available)
 - Drive unit consists of new SCSI double-speed drive, custom enclosure, and detachable Bose active speakers with 10W/Channel amplifiers.
 - Includes Pro-Audio Spectrum 16 SCSI sound card, with special interconnect cable.
 - MPC & MPC2-compliant, true 16-bit stereo sound
 - Midi ports and audio jacks on back, NEC CDR210 CD-ROM Drive has tray, does not need caddies.
 - Supports DOS, Windows 3.1, Sound Blaster and Ad-Lib, joystick and full-duplex MIDI, so it can run nearly all audio applications ever made for PC's!
 - Awsome sound from Bose speakers!
 - Comes with copies of instruction manual, power supply, installation software, 90-day warranty



Media Vision Memphis kit HSC# 15753 \$159.95

Bargain SCSI Sound Card!

- Mediavision **ProAudio Spectrum 16** sound card
- 16-bit audio, 44.1KHz stereo sound
- MPU 401 MIDI emulation, Soundblaster compatible
- Internal SCSI CD-ROM port, microphone jack (mike not included), line-in, speaker jack, joystick port
- Includes driver disk, information sheet (no book)
- OEM package (no box), 90-day warranty

HSC#15797 \$39.95

1200 dpi Color Scanner!

- Dexxa sheet-feed full page (8.5" x 11") color scanner
- 1200 dpi, 24-bit TWAIN interface, Windows compatible
- Brand new in box with extensive software bundle
- Includes OCR Album, Fax, Copy, Image editing, Slide Show, Electronic Database
- IBM interface card & cables included
- Made by Logitech -- One Year Factory Warranty

HSC#15775

\$249.95

Remote Control for your Computer!



- Infrared Remote operates your computer from 50 feet
- Perfect for sales presentations, training, demonstrations
- Serial Interface (IBM version) or ADB (Mac version)
- Handheld remote is 7" x 2.5" x .5"
- Included software provides screen pointer for emphasis
- Keystroke mapping table can be customized, saved
- Roam the room, make eye contact with your audience
- Like using a TV set remote control (easy to set-up, use)

HSC# 15240 IBM Remote Keyboard \$29.95

HSC# 15241 Mac Remote Keyboard \$39.95

Optical Drive Jukebox Project

- Optical Drive Jukebox by International Data Engineering
- Set up for Panasonic drive, which is not included
- Changer mechanism stores and changes ten disks, and can be loaded or unloaded from front access slot
- Accepts 650MB, 1GB and 1.3GB optical disks
- SCSI Interface, software included
- Can be set up for other drives, including Maxtor, but will require fabrication of mounting brackets and alignment
- Installation manual includes alignment procedure
- Measures 12" x 12" x 18"
- New in box, 90-day warranty (if unmodified)



HSC#15773

\$295.00

Pentium Motherboards!

- New-in-box 66 MHz PCI Pentium Motherboard
- Four PCI Slots, Four 16-bit ISA Slots, uses 72-pin SIMM's
- ZIF Socket contains your choice of CPU, 60 or 66 MHz
- 256K Cache RAM installed, supports up to 1MB Cache
- PCI clock rates from 20 to 33 MHz supported
- User's manual included, ninety-day warranty

HSC# 15763 with 60MHz CPU \$179.00

HSC# 15796 with 66MHz CPU \$189.00

SCSI Drive Case Deal!

- Low-profile case for 5.25" drives
- Perfect for CD-ROM, hard drives
- 9.5" x 2.5" x 10.5" overall size
- 50-pin SCSI daisy-chain connectors
- Internal 50-pin cable, SCSI ID switch
- 35-watt power supply delivers 5VDC @ 2A, 12VDC @ 2A
- Used case has 90-day warranty, may need some screws

HSC# 15744 Low-Profile 5.25" Drive Case \$24.95

Lower CD-ROM Prices!

- Tested Good CD-ROM Drives removed from systems
- 90-Day Warranty
- 2x and 3x Speeds available
- First two drives are tray-type (no caddy needed)

Sanyo CDH-94 2X-Drive HSC# 98435 \$49.00

NEC CDR-55J 2X-Drive HSC# 98436 \$49.00

NEC CDR-84J 2X-Drive HSC# 15648 \$49.00

NEC CDR-510 3X-Drive HSC# 15327 \$79.00

Bargain Game Controller!

- Quickshot QS-191 Game pad for IBM Compatibles
- Faster action, less fatigue than a joystick
- Why pay more for a game device?
- Brand new, plugs into 15-pin game port



HSC#15594

\$3.95

Motor Mania!

- Small (1.5" x 1.5" x 1") Stepper Motor, 13.2VDC, 45A/Φ, 200 steps per revolution. No spec. sheet available yet.

HSC# 15597 \$5.95

- Small (1.625" x 1.625" x 1.25") Stepper Motor, 12VDC, 210A/Φ, 100 steps per revolution. Shaft is .125" dia., has .75" dia. crowned pulley for flat belt. Made by Berger Lahr, data sheet with connection diagram (in German) included.

HSC# 15751 \$6.95

- Small (1.75" dia x 1.875" overall body dim.) Linear Actuator Stepper Motor, 12VDC @ 5 Watts, 1" overall travel. .003" per step. Has 32 oz. (8.9N) maximum force, 8 oz. (2.2N) unenergized holding force. Shaft has .125" long x .0625" tip to attach item being moved, shaft does not rotate when actuated. Neat robotics actuator! Mfg. by Airpax, no connection diagram, but spec. sheet is included.

HSC# 15750 \$12.50

- Medium (1.5" dia. x 3") Pittman Motor, 19.1 VDC, with optical shaft encoder. Sorry, no data sheet available yet.

HSC# 15654 \$9.95

- Large (3.25" dia. x 6.25") 20VDC @ 5.7A Sanyo Denki permanent magnet DC Reel Motor, 9/16" shaft is stepped down to 1/2", 580rpm, or use as 70W generator! Attention robotics enthusiasts...this is a heavy-duty beauty!

HSC# 15327 \$27.50

Mini-Tower Power Supply

- "Mini-tower" power supply, pulled from new computers
- Fits most Mini- and Mid-size tower cases as well as many small-footprint desk-top cases. 230W
- Measures 6" x 5.5" x 3.5"
- Has normal motherboard connectors, three large and two small drive connectors on 12" leads
- Push-type power switch on 18" lead.



HSC# 15736 New Lower Price! \$17.95

Digital Multimeter Deal!

- Low-cost Digital Multimeter with High-end Features!
- 3.5 Digit, case measures 2.75" x 5" x 1"
- DCV to 1KV, ACV to 750
- DC Current to 10A, Ohms to 2 Meg
- Diode, Transistor check with hFE
- Test Leads, 9V Battery included.
- Brand New, 90-day warranty



HSC# 80370

\$19.95

Large assortment of AC Adaptors!

Fig.	Output	Plug	HSC#	Price
A	5VDC @ 500mA, ±12VDC @ 130mA	5p. DIN/M	12634	\$4.95
A	5VDC @ 500mA, 12VDC @ 1A	5p. DIN/M	15140	\$9.95
C	5VDC @ 600mA, ±12VDC @ 250mA	5p. DIN/M	15325	\$12.50
C	5VDC @ 700mA, 12VDC @ 500mA	5p. DIN/M	15532	\$4.95
A	5VDC @ 750mA, ±12VDC @ 500mA, 150mA	5p. DIN/M	12634	\$14.95
C	5VDC @ 3A (IEC Cord not included)	4p. DIN/F	14996	\$5.95
B	5VDC @ 3.5A	3.5mm Coax	15570	\$8.95
B	6VDC @ 2A	2.5mm Coax	15569	\$9.95
B	9VDC @ 200 mA	2.5mm	15571	\$3.95
C	12VDC @ 500mA	6p. Molex	15668	\$4.95
A	12VDC @ 2.5A	6p. Molex	15450	\$12.50
B	13.5VDC @ 1.5A	Special Coax	15643	\$9.95
B	18VDC @ 300mA	None	14024	\$1.95
C	9VAC @ 400 mA	3mm Coax	13000	\$3.95
C	9VAC @ 1.7A	3mm Coax	12796	\$5.95
A	10VAC @ 2.2A	Screw Term.	13918	\$5.95
B	12VAC @ 9.6A	3.5mm Coax	15372	\$5.95
A	14VAC (CT) @ 1.1A	3p. Molex	14617	\$7.95
B	15VAC @ 100mA	2.5mm	11797	\$1.95
B	16VAC @ 300mA	None	12916	\$3.95
C	16VAC @ 1A (110/220VAC Input)	2.5mm Coax	15700	\$7.95
A	16.2VAC @ 1.1A	2.5mm Coax	15152	\$3.95
C	16.4VAC(CT) @ 1.4A, 25.6VAC(CT) @ 180mA	6p. DIN/M	15309	\$7.95
A	18VAC @ 550mA	5p. Molex	15399	\$3.95
B	20VAC @ 400 mA	3mm Coax	12601	\$4.29



PCMCIA Sound Card!

- Media Vision PCMCIA 16-Bit Sound Card
- Great for Portables, Laptops with PCMCIA Slot
- External Pod has Joystick Port, Mic. input, Line In & Line Out jacks, Volume control.
- Microphone included
- Installation software, instructions included
- New in OEM packaging
- 90-day warranty

Media Vision PCMCIA Sound Card HSC# 15585 \$39.95

Visit HSC's Website!

- HSC has a new presence on the Internet World Wide Web!
- Simply point your browser to <http://www.halted.com>
- Site is under construction, please be patient!
- Plans include latest specials, on-line database, more!

You can still subscribe to our e-mail "Mailing list", just send a posting to HSC-server@hsc.cue.com with the single line message: **SUBSCRIBE HSCmail <full name>**
You will get future unsolicited mailings. You can "Unsubscribe" at any time in the same manner.

<http://www.halted.com>

Terms: Some quantities limited, all items subject to prior sale. Minimum order: \$10.00 plus shipping. Orders under \$20.00 subject to \$2.00 handling fee, in addition to shipping. All orders shipped FOB Santa Clara, CA (this means you pay freight!) by UPS Surface (no P.O. Boxes) unless otherwise specified, in which case prevailing carrier rate plus \$5.00 handling fee applies. Prepaid orders that don't include shipping charges will be shipped freight COD. There is a \$4.75 UPS charge added to shipping charges for COD shipments. If you have questions about your order, please call Customer Service at (408) 732-1854 M-F 9AM to 5PM PST.

NUTS & VOLTS MAGAZINE

Published Monthly By
T & L Publications, Inc.
430 Princeland Court
Corona, CA 91719
(909) 371-8497
FAX (909) 371-3052
CompuServe ID# 74262,3664
Internet
74262.3664@compuserve.com

**Subscription
Order ONLY Line
1-800-783-4624**

Publisher
Jack Lemieux
N6ZTD

Editor
Larry Lemieux
KD6UWV

Managing Editor
Robin Nelson
KD6UWS

On-The-Road Exhibit
Coordinator
Audrey Lemieux
N6VXW

Events Calendar
Shawn Vander Ploeg

Subscriptions
Natalie C. Sigafus

Classified Ads
Lisa Wharton

Copyright 1996
by T & L Publications, Inc.
All Rights Reserved

NOTICE TO ADVERTISERS

All advertising is subject to publisher's approval. We are not responsible for mistakes, misprints or typographical errors. Nuts & Volts Magazine assumes no responsibility for the availability or condition of advertised items or for the honesty of the advertiser. The publisher makes no claims for the legality of any item advertised in Nuts & Volts. This is the sole responsibility of the advertiser. Advertisers and their agencies agree to indemnify and protect the publisher from any and all claims, action or expense arising from advertising placed in Nuts & Volts.

Please send all subscription orders, correspondence, UPS, overnight mail and artwork to: 430 Princeland Court, Corona, CA 91719.

The closing date for each issue is the 10th of the prior month, e.g., the closing date for the June issue is May 10th. Ad copy to be typeset by Nuts & Volts should be received one week prior to the closing date.

Call or write for current advertising rates.

CONTENTS

VOLUME 17 NO. 3 MARCH 1996

ARTICLES

- DIGITAL SATELLITE SERVICE** Michael Posner.....16
DSS offers more channels, higher-resolution viewing, easier channel surfing, plus more than traditional cable TV.
- REAL-WORLD POWER FOR THE BS2!** Scott Edwards.....23
This data collection proto board for the Stamp II computer adds analog input, 32K storage, and a real-time clock.
- VOICE RECORDING AND PLAYBACK:
LOOK — NO TAPE!** Ronald Rels and Jimmy Te.....44
This project lets you "yack" it up without tapes, CDs, A/D or D/A converters, or microprocessors.
- OVERBOARD ALARM** Gordon West.....52
Stay "ALERT" with this water-activated emergency transmitter and companion alarm receiver.
- TODAY'S ELECTRONICS** Anthony Charlton.....114
What's available in integrated circuit voltage references.

COLUMNS

- AMATEUR ROBOTICS** Karl Lunt.....84
Wheel encoders.
- OPEN CHANNEL** Joseph J. Carr K4IPV.....7
More on VLF monitoring.
- RESOURCE BIN** Don Lancaster.....65
Injection molding and plastic prototyping.
- SOFTWARE WIZARDRY** Harry Helms.....72
Solving common Windows PC problems.
- STAMP APPLICATIONS** Scott Edwards.....94
Catching and correcting operating errors plus a few bits of Boolean logic.
- THE LASER EXPERIMENTER** Anthony Charlton.....34
Homebrew laser projects.
- THE SOLDERLESS BREADBOX** Don Wilcher.....106
Playing around with potentiometers.

DEPARTMENTS

- ADVERTISER'S INDEX**.....120
- CLASSIFIED AD INFO**.....120
- DEALER DIRECTORY**.....102
- EVENTS CALENDAR**.....78
- NEW PRODUCT NEWS**.....42
- NV ADMART**.....92
- READER FEEDBACK**.....5
- TECH FORUM**.....58

To Subscribe to NUTS & VOLTS

Send payment to the address below or call 1-800-783-4624
and use your Visa or MasterCard.

USA ONLY

\$19.00 — One Year

\$35.00 — Two Years

MAILED FIRST CLASS — FOREIGN ONLY

\$50.00 — Canada/Mexico

\$100.00 — Foreign/Air Mail

\$50.00 — Foreign/Surface

Nuts & Volts Magazine, 430 Princeland Court, Corona, CA 91719

EDITORIAL CONTRIBUTIONS

Nuts & Volts Magazine encourages article submissions and queries. Send a SASE for a copy of our writer's guidelines.

All submissions should be on 5-1/4 or 3-1/2 inch diskettes and include hard copy as well. If return of materials is requested, include a SASE with your submission.

Deadlines should be discussed in advance with the editor, but generally all material should be submitted by the 1st of the month for the next month's issue.

CHANGE OF ADDRESS

If you are moving, notify us AS SOON AS POSSIBLE so we can continue your subscription without interruption.

Your magazine WILL NOT automatically be forwarded to you by the post office, so it's important to submit your change of address directly to Nuts & Volts.

We will not be able to replace missed issues of the magazine due to unreported address changes.

When you send in your new address, include a current mailing label from the magazine with your account number on it. If you do not have a mailing label, be sure to include your old address and the name(s) under which the subscription was submitted.

INDEX TO CLASSIFIED ADS

- Ham Gear for Sale.....5
- Ham Gear Wanted.....11
- CB/Scanners.....12
- Music & Accessories.....14
- Computer Hardware.....14
- Computer Software.....29
- Computer Equip. Wanted.....38
- Test Equipment.....38
- Security.....57
- Satellite Equipment.....61
- Military Surplus Electronics.....69
- Audio/Video/Lasers.....69
- Cable TV.....70
- Telephone/Fax.....82
- Components.....91
- Microcontrollers.....98
- Antique Electronics.....98
- Aviation Electronics.....99
- Publications.....99
- Robotics.....100
- Plans/Kits/Schematics.....104
- Manuals/Schematics
Wanted.....108
- Misc. Electronics For Sale.....109
- Misc. Electronics Wanted.....113
- BBS & Online Services.....116
- Education.....117
- Business Opportunities.....117
- Repairs/Services.....117

Nuts & Volts Magazine is published monthly for \$19.00 per year by T&L Publications, Inc., 430 Princeland Court, Corona, CA. Application to mail at 2nd class postage rates is pending at Corona and San Diego. POSTMASTER: Send address changes to Nuts & Volts Magazine, 430 Princeland Court, Corona, CA 91719.

reader FeedBack

Dear Nuts & Volts:

Your Jan. '96 cover article, "Circuit Design Software Under \$100.00" by T. J. Byers, is really up there with some of the best articles that I've seen. As a professional consultant to manufacturers of PC board prototype-making materials for many years, I appreciate the extensive effort that Mr. Byers had to have put into this article (whew!). This is high-quality stuff, well written, and seems to be part of a pattern in *Nuts & Volts* articles. Please don't stop.

As a consultant to the people that market PCData software, I was naturally quite pleased that we did get some mention on page 20. Unfortunately, we really buried one of the program's most important features which no doubt resulted in Mr. Byers not mentioning it. And that is that PCData also permits the user to easily design a footprint for any new component and add it to the software's library. Future packaging and manuals will make this very important feature clear so that a user will see this feature "up front."

Robert C. Reynolds
Corrales, NM

Dear Nuts & Volts:

I want to thank the staff and editors for publishing my question (#129524, Dec. '95), as well as the answer to this question, which you sent to me. Thanks, it helps a lot. I want to thank Ray Shetrone of Ft. Myers, FL for his answer. I was using an old schematic for a D-104 which had the resistor R-5 (emitter of second transistor misprinted as 180 K) which was one of the problems I was having. The N3904 transistors I knew would substitute, but the .01 cap I failed to include, my mistake. Not having the formula to figure the resistance of R1, and R5 being incorrect, the preamp didn't work correctly. Thanks again to all of you — staff, editors, and Mr. Ray Shetrone.

Don L. Reynolds
Lexington, OK

Dear Nuts & Volts:

I am putting pen to pad extending my congratulations for your selection to print "Build a Sound Activated Christmas Tree" kit as described in the Nov. '95 issue.

My kit was ordered from Cal West Supply, Inc., and received a short time later. The instructions were very thorough and well presented. I was impressed that IC sockets were provided; most kits don't do that today. And also solder was provided, just the right amount! The PC board is very professional. About the only time-consuming item was identifying the placement of the various colors' LEDs. Once built, and making all the various double checks,

my tree performed as described.

The timing of this kit was perfect, just before Christmas. This tree was the talk of my home. Everyone enjoyed it, especially the kids! Placing the tree on top of a TV or radio was really an experience!

The only problem experienced was with the provided microphone. For some reason, the one provided seemed not to be very sensitive. I replaced it with Radio Shack's P/N 270-090 which worked very well. I don't know whether the mic provided was defective or was less sensitive than Radio Shack's.

At any rate, the tree has been saved with the other Christmas items to enjoy again next year!

Ray L. Heller
Manassas, VA

Dear Nuts & Volts:

I love your magazine and have subscribed to it for several years now. I just received the February issue and much to my horror, you have seen fit to totally destroy one of my favorite sections: The Events Calendar! I hope this is a one-time thing and that you will be going back to the old format where you actually give us some information we can use, instead of one liners and a long distance telephone number for each event. For the past few years, I have been resubscribing to your magazine at the Dayton, OH hamfest. I regret to say that I will not be this year if this is what we can expect of your magazine in the future.

Harold McCall
Sycamore, OH

Editors Note:

Rising paper, postal, and production costs have taken their toll on us, just like other publications. It was necessary to trim down some features (like the events calendar) to save space. We have added the show locations back into the calendar this month and are considering some other space saving alternatives.

Dear Nuts & Volts:

I just finished reading Damien Thorn's article titled "Secret Service Targets 'Extension' Cloner." I could not agree more with Mr. Thorn. I especially enjoyed the critique of Special Agent Cobb's affidavit. Sounds like a case of guilty until proven innocent. Mr. Thorn brought up some very important facts that need to be considered. I am not advocating cloning for illegal use, since I am a cellular user myself who would love to legally have two phones on the same number. I can only hope for a not guilty verdict for Mr. Yates.

Mike Farwig
Rolla, MO

HAM GEAR FOR SALE

MOTOROLA PAGERS: Optix and PMR2000 alphanumeric display and voice w/charging stand and belt holster \$50 ea. J&H Comm., 916-334-8473.

NATIONAL RADIO manuals and MCL2000 parts lists. SASE. Maximilian Associates, 11 Plymouth Lane, Swampscott, MA 01907.

FREE ELECTRONICS CATALOG. Quality parts at surplus prices. All new, never used distributor and OEM overstocks. Call IME, 817-473-1730 or write PO Box 170415, Arlington, TX 76003.

RCI-2950/2970 Modification Manual. Tune-up, audio, receiver, noise-blanker & clarifier modifications. Microphone wiring & more. \$20 ppd w/money order, \$25.50 COD. Scott, PO Box 510408, St. Louis, MO 63151-0408. 314-846-0252.



THE ALC245M AUTOMATIC VOLUME CONTROLLER will keep your transceiver or scanner volume constant from a whisper to a scream. \$29.95. Other models are also available. **FREE BROCHURE.** C&S Electronics, PO Box 2142, Norwalk, CT 06852-2142. Phone/FAX 203-866-3208.

MICROWAVE X-BAND 10GHz Gunn xceivers, 2 for \$25. Horn ant. kits, \$15. For wide-band FM voice, video, or 2MB/sec data. SASE for info. Gary Krancher WB1AUA, 1502 Old North Colony Road, Meriden, CT 06450. 203-634-3006.

LOW PRICE quality two-way gear. GE Mstr. 2 40W on 52.525 complete \$50. Mot. Mitrec 45W on 146.520 or 145.07 complete \$65. Mot. Micor 100W on 146.520 complete \$75. Large list of used two-way radio. GE vehicular repeater 450 1/2W w/2nd receiver, microprocessor based w/cable & parcel manual \$60. Mot. MRC100 VHF 15W great little mobile to use on packet or 1 & 2 channel in the car w/parts and instructions to convert to front mount and put on ham band \$20. Conversion books for GE & Motorola. For list, call 909-873-1319 or FAX 909-820-1885. E-Mail: HRH6@AOL.COM or write LML, 424 E. Shamrock, Rialto, CA 92376.



THE ELECTRONIC EXPERIMENTER'S JOURNAL. It's part catalog, part magazine, part data book. Kits, plans, schematics, computers, parts, articles, ideas, and application notes. Get your **FREE** copy today by calling 1-800-423-4499 or FAX to 513-531-4455. Debco Electronics, 4025 Edwards Rd., Cincinnati, OH 45209.

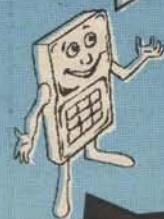
MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-842-5953, FAX: 818-845-3613.

WANTED: ROCKWELL-Collins HF-8021 3KW Amp. 237B-3 rotatable directional HF antenna. Jim Stitzinger, 805-259-2011, fax 805-259-3830.

TUBE SALE: 6KD6, 6KG6, 6KV6A, 6LQ6, 6LX6, 6LB6, 6JS6C, 6LF6, 6JB6A, 6ME6, 6LR6, 6KN6, 20LF6, 26LX6, 26HV5, 30KD6, and many more. All tubes are new old stock in their original boxes. Tested and guaranteed, lowest prices around. Call Don, 715-246-3899.

CATALOG. CHOKES, inductors, ferrite, powdered iron cores, components, semiconductors, more. Two stamps. Johnson Shop Products, Box 2843, Cupertino, CA 95015.

WE BUY!!!



**NEW
or
USED!**

**CABLE
EQUIPMENT!**

- We Buy All Types U.S. Systems
- Offers of 200 Pieces Or More
- CALL TODAY!

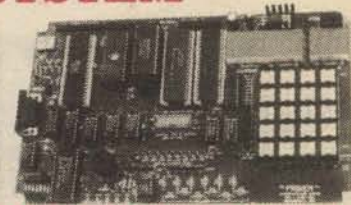
1 402 392-2284

FAX: 1 402 392-0991

**Ask For Purchasing...
and
Let's Deal!!**

Write in 216 on Reader Service Card.

**THE BEST
8085 MICRO-
PROCESSOR
TRAINING
SYSTEM**



JUST GOT BETTER!

No other training system we know of comes close to matching the PRIMER's features at this low price. The PRIMER teaches more and is easier to use than other comparably priced trainers. The over 100 page Self Instruction manual takes you from binary number systems, to processing interrupts. At the end of the manual are working examples of using a photocell, a temperature sensor, making a wave form generator, a timer with alarm, and a motor speed controller using back EMF. The PRIMER comes with everything you need to start programming the 8085 in machine language. Continue on to program in Assembler, Forth, and BASIC with optional upgrade and software. Upgrade includes: RS232 serial port, cable, and 32K of battery backed RAM. Picture shown with upgrade option and optional heavy-duty keypad installed. The PRIMER is \$119.95 in kit form. The PRIMER assembled & tested by EMAC is \$169.95. Order now and receive one free power supply. Please add \$5.00 for shipping in USA.

EMAC, inc.

**618-529-4525 FAX: 618-457-0110
BBS: 529-5708 ~ P.O. BOX 2042
CARBONDALE, IL 62902**

Write in 61 on Reader Service Card.

MORE for LESS... Always!

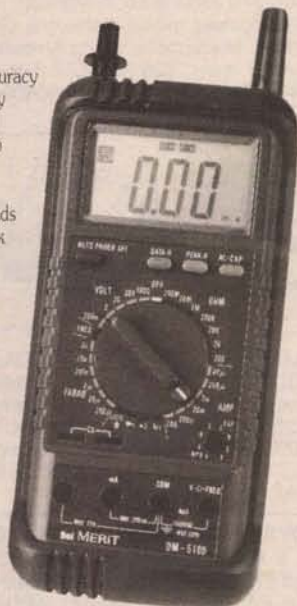
Best Values for Performance, Features and Dependability

DM5050C, 42 Range DMM + CAPACITANCE METER

- Digital Multimeter
 - Resistance - Up to 2,000 MΩ
- Capacitance Meter, Extended Range
 - Up to 20,000 μF (9 Range)
 - Zero Adjust Knob
 - Test Leads and Built-in Socket
 - Check Motor Starting & Running Capacitance
- Triggering Lamp

DM5100, 45 Range WIDE RANGE, ELEVEN FUNCTION

- Auto Power Off, Data & Peak Hold
- Measures Wider Range
 - Frequency - Up to 20 MHz
 - Capacitance - Up to 200 μF
 - Resistance - Up to 200 MΩ
 - Current - Up to 20 A AC/DC
- Logic - TTL
- TRHFE



± 0.25% Basic DCV Accuracy
1.5" Big LCD Display
3 1/2 Digit Manual
AC/DC Volt & Amp
Resistance, Diode
Continuity Beeper
Alligator Clip Test Leads
Double Insulated Jack
Deluxe Holster
• Lead Holders
• Velcro Hanger
Tilt Stand

\$89

- Prices start at \$44.95, measuring AC/DC 10 Amp. & Volt, Resistance, more and including protective Holster
- Lots more High Standard Test Instruments available
All in One Instrument, Oscilloscope, Power Supply, Function Generator, Freq. Counter, Multimeter, Capacitance, Engine Analyzer, Clamp-On, Electrical Tester and More.
- See your local distributors or Call for Catalog

Bel MERIT
SOLUTIONS FOR THE TEST INSTRUMENT

26242 Dimension Dr., Suite 110
Lake Forest, CA 92630
(714) 586-3700 • FAX: (714) 586-3399

Write in 138 on Reader Service Card.



CUNARD ASSOCIATES

R D 6 Box 104, BEDFORD, PA 15522
TEL / FAX 814 623 7000

THE POWER PRO

IF YOU NEED NEW BATTERIES FOR YOUR ELECTRONIC EQUIPMENT
DON'T PITCH EM! SEND THEM TO US FOR REBUILDING!

- WE INSTALL NEW Ni-CAD BATTERIES INTO YOUR ORIGINAL CASE.
- WE IMPROVE CAPACITY TO BETTER THAN ORIGINAL.
- WE FIX WHAT CAN'T BE FOUND. (OR AFFORDED)
- WE PROVIDE QUICK SERVICE. / EXTENDED LIFE FOR OLDER EQUIPMENT.
- WE PROVIDE FREE QUOTES. / FREE RETURN IF QUOTE IS REFUSED.
- WE PROPERLY DISPOSE OF YOUR OLD CELLS BY RECYCLING.
- WE GIVE YOU A 12 MONTH WARRANTY.
- WE WILL BE HERE WHEN YOU NEED US. / 10 YEARS IN THIS BUSINESS.
- WE SAVE YOU \$\$\$ MONEY !!!!!!



ALL MAKES
& MODELS

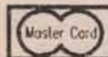
FOR MORE INFORMATION ABOUT YOUR PARTICULAR NEEDS, WE CAN BE CONTACTED
VIA PHONE OR FAX AT (814) 623-7000 OR VIA E-MAIL TO: ZAPPEM@AOL.COM
OR SEND YOUR PACKS FOR QUOTATION VIA UPS OR PRIORITY MAIL TO ADDRESS ABOVE.

GENERAL ELECTRIC	STANDARD	BENDIX KING
MPD/PLS - MPR/MPX/MPX	CNB111/HWA110 \$29.95	KR105/LAA125 \$34.95
19A701850P(1200mAh) \$34.95	CNB120/HWA120 \$34.95	
19A704860P(1800mAh) \$39.95	CNB121/152/153 \$39.95	
PL19D429763G1/3 \$34.95		
PL19D429777G1/3 \$39.95		
MOTOROLA	UNIDEN	KENWOOD
P200/MT600/MT1000	APX650 \$34.95	PB2 / KNB3 \$29.95
NTN5521/4585/4824/5414 \$37.95	APX1200 \$39.95	PB21/21H \$14.95
	BP100/200/205 \$19.95	PB25/H/26 \$24.95
MIDLAND	ICOM	YAESU
70-B06 / 70-B11 \$27.95	BP2 / BP3 / BP22 \$18.95	FNB3/4/12/27 \$32.95
70-B10 / B16 / B19 / B21 \$39.95	BP5 / BP23 / 24 \$24.95	FNB11/14/26 \$32.95
	BP7 / CM7 / BP8 \$34.95	FNB17/25 \$23.95
		COMPUTERS
		SEND PACK FOR QUOTE

BATTERY REBUILD SERVICE

MANY OTHERS AVAILABLE WRITE OR CALL

FREE CATALOG
ADD \$4.50 SHIPPING & HANDLING PER ORDER



EPROM+

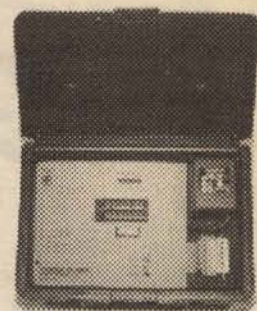
THE ORIGINAL PARALLEL PORT
PROGRAMMING SYSTEM!

A DEVICE PROGRAMMER FOR BENCH AND FIELD

EEPROMS (UV & FLASH) (24, 28, 32, 40* PIN PLUS 27C, 29C, 28F & 29F)
1702*, 2708, TMS2716*, 2716, 32, 32A, 64, 64A, 128, 128A, 256, 512, 513, 011, 010, 101
1001, 1000, 1024, 210, 020, 2001, 220, 2048, 4001, 040, 080, 240, 4096, 2516, 32, 64, 68764
EEPROMS AND NVRAMS (18, 24 & 28 PIN PLUS CXXX) X2210, 2212
2804, 2816, 2816A, 2817, 2864, 2865, 28C256, 28C010, DS12XX
SERIAL EEPROMS* (8 & 14 PIN PLUS CXX) ER1400, M58657, 2401, 02
04, 08, 16, 32, 44, 64, 65, 59C11, 80011A, 8572, 82, 92, 9306, 46, 56, 66, 16811, 16911
BIPOLAR PROMS* (16 THROUGH 24 PIN) 74SXXX, 82SXXX FAMILY
MICROCONTROLLERS* (UV, EE AND FLASH) 8741, 42, 48, 48H, 49, 49H
8751, 87C51, 52, 87C5XXX, 87C75X, 89C51, 52, 89C1051, 2051, 68705, 68HC705
68HC711E9, PIC16C54, 55, 56, 57, 58, 61, 64, 620, 621, 622, 71, 74, 84, TMS7742
*ADAPTER REQUIRED - DIAGRAMS INCLUDED IN MANUAL

- SOFTWARE - READ, VERIFY, PROGRAM, COPY, DISK FILE LOAD & SAVE, CHECKSUM, FULL SCREEN BUFFER EDITOR W/20 CMDS
- READS INTEL HEX, MOTOROLA S-RECORD AND BINARY FILES
- FAST-MOST DEVICES PROGRAM IN UNDER 20 SECONDS
- RUGGED (9"X6"X3") PORTABLE ENCLOSURE W/CARRY HANDLE
- MADE IN THE USA - 30 DAY MONEY BACK GUARANTEE
- SYSTEM INCLUDES: PROGRAMMING UNIT, PRINTED MANUAL, PRINTER PORT CABLE, POWER PACK AND SOFTWARE

ANDROMEDA RESEARCH, P.O. BOX 222, MILFORD, OHIO 45150
(513) 831-9708 FAX (513) 831-7562



\$289

ADD \$5.00 SHIPPING
\$5.00 COD
VISA / MASTERCARD

ANTENNA SPECIALISTS MONR/31 tri-band
(26-55, 138-174, 407-512 MHz) base station
monitor ant. Special order by state of CA to
scan lower bands and tranceive (w/6dB gain)
on UHF to 150W, new in box \$40 ea. J&H
Comm., 916-334-8473.



ELECTRONICS BOOKS. Thousands of
titles. Electronics meet. Aviation at Marine,
Manhattan Beach 7-11am, last Saturday
each month. We also buy. Lee and Margaret
Johnson, 805-525-8955.

KENWOOD TWINS, R-599A receiver, T-
599A transmitter both in excellent condition
\$400. J&H Comm., 916-334-8473.

ROCKWELL/COLLINS KWMZA 312B5,
30L1, 30S1, S-line. Also parts radios. Schaaf,
614-383-6767, ext. 114.

PACKET FOR Commodore 64 users.
Digicom modem wired, tested. Software and
documents. \$49. Crawford Amateur Radio
Society, PO Box 653, Meadville, PA 16335.

MILITARY RADIOS: Easily made battery
adapters for military radios & other electron-
ics. Get "Power Up," big new 96 page manual
of instructions, diagrams. Use readily avail-
able commercial batteries in PRC-6, -8, -9, -
10, -28, -25, -47, -74, -77, TRC-77, AN/PRR-
9, AN/PRT-4, RT-77, URC-68, more, also
mine detectors, night scopes, radars, field
telephones, etc. Only \$14.95, plus \$5 S/H (\$6
Canada). NYS residents add \$1.66 tax. CRB
Research, Box 56-NVV, Commack, NY
11725. Visa/MasterCard welcome. Phone:
516-543-9169.

ALL YAESU, FL101 HF transmitter, FR101S
HF VHF receiver, FR101 digital HF VHF
receiver, FV101B ext. VFO, FTV650B,
FTV250, 6 meter and 2 meter transverters.
101 filters AM, CW, FM, SSB FR101 convert-
er boards VHF, etc. Selling everything.
Buy/sell tubes, 8643, 6146B, 6F56C,
4X150A, 4X150D, 4CX250B, 4CX300A, etc.
Tim Bryan, 717-323-4055.

NEW HAM starting out, looking for equipment
of any kind. Transceivers, receivers, anten-
nas, base or mobile. Will pay fair price for
equipment. Mike, 315-732-4507 or 315-734-
5770.

KENWOOD R-1000 shortwave receiver
100KHz to 30MHz. Very clean, excellent
working condition. \$275. MicroCraft
RTTY/Morse reader with 8-LED display plus
both serial and parallel output options \$75.
Phone Bill at 520-297-6166 or E-Mail to:
bill_h@azstarnet.com

HRO 600 ex. cond. \$3,800. Rockwell-Collins
HF8054 \$2,000. HF8014 \$2,000.
HF8023/8032 1KW amp \$4,500. HF8096
processor \$600. The lot \$8,000. Jim
Stitzinger, 805-259-2011, FAX 805-259-3830.

FOR SALE: Heathkit SB-500 2 meter SSB &
CW transverter. Good condition. I ship \$80.
Sandy WB4EVH, ph. 912-953-9104 after
6pm EST.

POWER INVERTERS 10, 5 to 16.5 VDC in,
115VAC True RMS ±5% out @ 60Hz, modi-
fied sine wave, 90% efficiency, 2 yr. warranty.
100 watt (800W surge) \$89, 400 watt (3000W
surge) \$289, 700 watt (3000W surge) \$369,
1,300 watt (6000W surge) \$569. Dexis Corp.,
612-944-7670.

HF AMP SUNAIR ELEC. LPA 1900A,
4CX1500, 1.5 to 30MHz \$750, power supply
\$100. Bob, 415-332-3905, FAX 415-332-
1305, POB 1081, Sausalito, CA 94966.

FREE! THE ETC. Catalog of manuals for
amateur, audio & test equipment. A.G.
Tannenbaum, Box 386, Ambler, PA 19002.
215-540-8055, FAX 215-540-8327.

GMRS-UHF Communication to 50 watts
with no test license. Great new way to keep
in touch with non-ham family members. Send
or call for free info on the great new radios for
GMRS. Sports Communications, Box 36,
Scotts Mills, OR 97375. 1-800-573-2256.
Hours 9-5 Pacific Time, M-F.

NEW LOW COST COMPACT LASER

650 nm laser pointer

- 5 TIMES BRIGHTER
actual size

- only 2.3" Length
- Solid aircraft aluminum housing
- 3-4mW output
- Includes 3 silver oxide watch batteries
- Life 2-3 years
- Warranty 1 year

PRICE: \$59.00

This laser blazes like a torch.

TO ORDER CALL

1 (800) 996-6873



HI-Q PRODUCTS, INC.

506 N. Garfield Ave., Suite 200, Alhambra, CA 91801

TEL: (818) 308-4400 FAX: (818) 308-4406

More On VLF Monitoring

Open Channel

by Joseph J. Carr
K4IPV

What radio activity I've engaged in for the past few months has been limited by a heavy work schedule, and a heavy writing schedule, and a few health problems, and has been on the VLF bands. Those bands are a rich lode for the scientifically-oriented who want to study odd propagation phenomenon. Recently, for example, I was able to receive the powerhouse station in western Ireland on 252 KHz. As a result of my columns, I've received a fair amount of mail and a load of E-Mail (carrjj@aol.com) on the subject. A lot of the requests were for lists of VLF radio stations, and others were for a list of references (from at least three science fair students, I might add). These are provided for other readers in Tables "A" and "B," respectively.

What You'll See (or Hear)

Many of the signals on the VLF bands are not easily interpreted by humans because they are not voice modulation and they are Morse code (although some are). In many cases, the signals will be pulses or other forms of modulation. A very common form is shown in Figures 1 and 2. Both of these illustrations are of the same set of signals (21 and 24.5 KHz), but with the oscilloscope time base set to different values. The "macro" view of the two different frequencies is shown in Figure 1. The 'scope was set for a relative long time base (1 mS or so), allowing you to see the pulse bursts as they go by. The top trace is for one of the two signals, and the bottom trace is the other.

An expanded view of the 24.5 KHz signal is shown in Figure 2. This view shows the amplitude shift digital modulation technique. Any form of digital modulation must use two different states to represent the two binary digits "0" and "1." On HF radioteletype (RTTY) signals, two different audio tones or two different RF frequencies (close to each other) are used for the two tones. But in the VLF band, a common form is the amplitude shift method in which one level represents "0" and the other represents "1" (a 10 dB separation between the levels makes distinguishing them easier).

Detecting these signals is relatively easy, although figuring out what they are saying is a bit harder. The method that I used was to connect an oscilloscope to the output of the receiver. The other is to use a rectifier/integrator circuit. The latter was used in the SID-hunters receivers that I covered earlier in this column. Art Stokes designed those receivers (several varieties), but I wanted to be able to look at the signal, so I added a buffered RF output amplifier to the original design. Figure 3 shows the block diagram for such a receiver.

The basic elements of the receiver are the RF tuning, the gain block, and the output circuits. The RF tuning could be inductor-capacitor (L-C) resonant tank circuits, or one of the varieties that use a gyrator circuit as a virtual inductor (Stokes' most recent design).

The gain block is a straight amplifier with a frequency response higher than the higher frequency that you want to receive, and a gain of

70 to 80 decibels (dB). I've used the three-stage transistor amplifier designed by Stokes, as well as transistor amplifiers of my own, operational amplifiers (CA-3140, CA-3240, NE-5534, and others), and the MAR-1 and MAR-6 devices. The MAR-x series are normally thought of as microwave MMIC devices, but they work down to near-DC, so they work well for VLF reception (each MAR-x provides about 18 dB of gain).

The rectifier/integrator is used to provide the DC output that drives the meter or any external recorders that you might wish to use. It consists of a 1N60 (or two 1N60's in a voltage doubler rectifier configuration). The integrator provides the time average of the input signal. You can use an operational amplifier Miller integrator if you wish, but a simple 100 to 470 μ F capacitor across the meter movement works well enough.

The RF buffer amplifier is any amplifier that will work on the frequencies of interest. I generally use a unity gain, noninverting follower operational amplifier for this function. The purpose of the amplifier is to provide an RF output without messing up the DC output (hence the term "buffered" — a buffer amplifier is any amplifier that provides isolation).

Boosting the Performance of Existing VLF Receivers

Others and myself have published various designs for VLF receivers. But many of you already have VLF receivers, or at least communications receivers that tune down to the VLF range. Many, many receivers tune to 100 KHz, while a substantial number are equipped to tune from as low as 25 KHz.

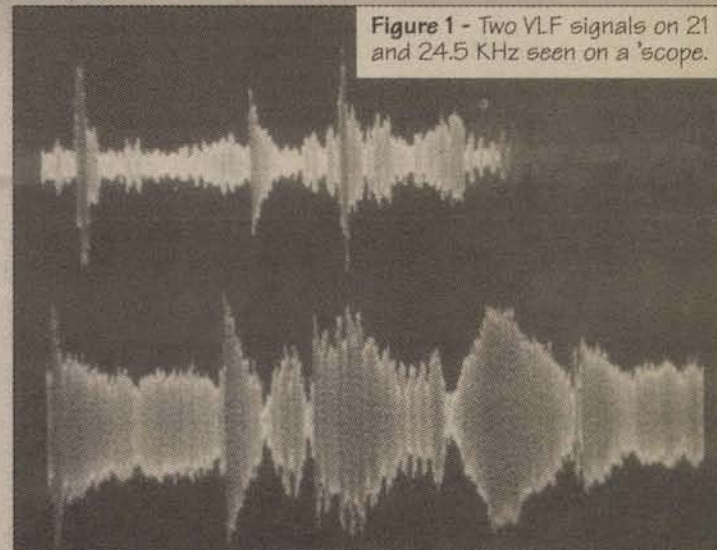


Figure 1 - Two VLF signals on 21 and 24.5 KHz seen on a 'scope.

Figure - 2 Expanded view of the 24.5 KHz.

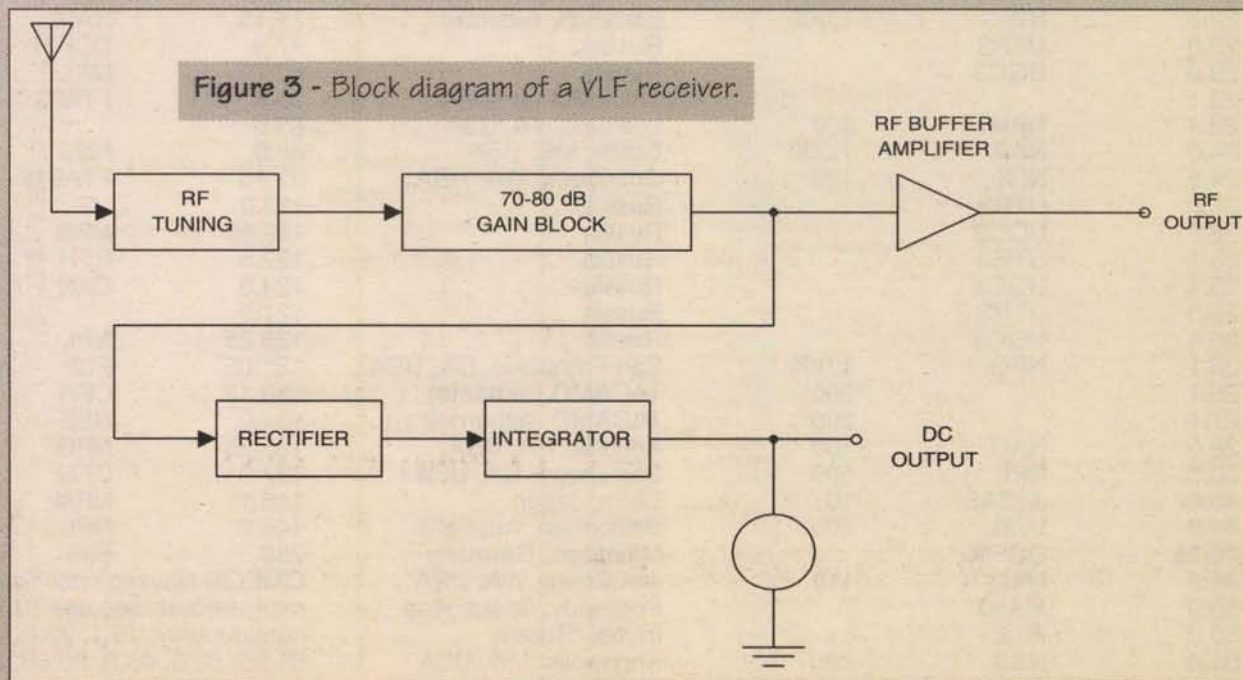
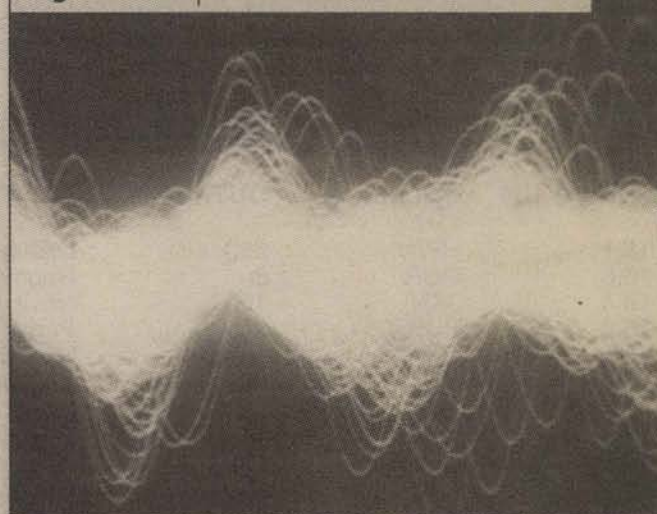


Figure 3 - Block diagram of a VLF receiver.

RF BUFFER
AMPLIFIER

RF
OUTPUT

RECTIFIER

INTEGRATOR

DC
OUTPUT

Open Channel

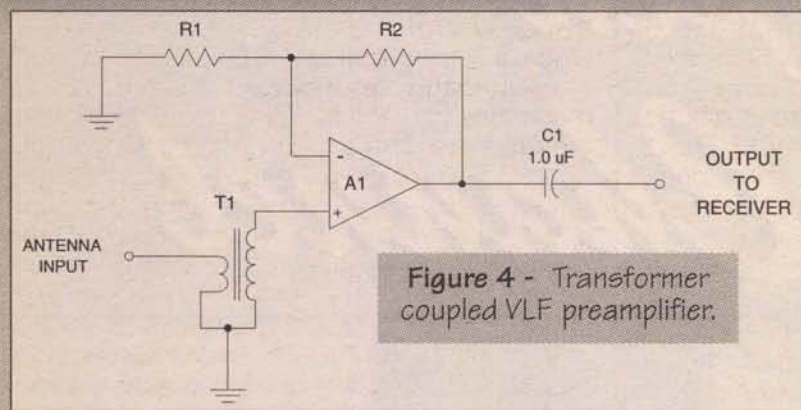


Figure 4 - Transformer coupled VLF preamplifier.

One fly in the ointment, however, is that these receivers are typically very poor performers on the VLF bands. While they may have super specs on the HF bands, they tend to dry up below the AM broadcast band. Indeed, some of them are puking on the 540-1700 KHz AM BCB.

Two things can be done to boost the performance of your receiver in these bands. One is to use a shielded loop antenna tuned to the desired frequency. A little difficult to tune and adjust sometimes, but a very good way to eliminate man-made and natural interference problems (which can be horrendous in the VLF bands!). We've discussed loops in this column before, and will do so again in the future.

The other approach is to use a preamplifier. It is relatively easy to gain an additional 5 to 20 dB of gain to beef up the front-end of the receiver. The preamplifier is placed between the antenna transmission line and the antenna input of the

receiver. In some loop antennas a preamplifier is placed inside the loop tuning box. Figures 4 and 5 show two approaches to using an operational amplifier for the preamplifier application.

The amplifier in Figure 4 uses an operational amplifier to set the gain, as is usual, but also uses the turns ratio of the input transformer to provide some gain, as well. The transformer (T1 in Figure 4) depends on the desired frequency range. Up to 100 or 120 KHz, you can use an ordinary

transistor radio audio output transformer. These transformers typically don't cut off immediately above the audio range, but rather go considerably higher. I tested several in Joe Carr's Basement Laboratory (where my family says I go to for "therapy") and found -3 dB bandwidths of 80 KHz for some cheap Radio Shack transformers, and up 120 KHz for commercial grade transformers. In all cases, there was a high turns ratio. The Radio Shack transformers were 1000Ω/8Ω audio output models. The 8Ω winding is normally the secondary, but, in this case, use it as the primary and connect it to the antenna. The commercial grade transformer was from Mouser and had a ratio of 600Ω/50Ω, and worked well to over 120 KHz (although the -3 dB point was 120 KHz).

An advantage of using the audio transformer is that they are inherently bandwidth limited. One of the possible consequences of using an amplifier is that signals on frequencies way out

side the band will adversely affect the receiver. By using bandwidth limitations on the front-end, however, these problems are significantly reduced.

The gain of this amplifier is set by:

$$A_v = \frac{N_s}{N_p} \times \left(\frac{R_2}{R_1} + 1 \right) \quad (1)$$

In general, it's best to use a low value (100 to 1,000 ohms) for R1, and then provide a higher value resistor for R2. For example, if you want a gain of 20 dB (voltage), then make R1 = 1,000 ohms and R2 = 10,000 ohms (or, if you need more gain, use 100,000 ohms for R2). Don't use more gain than is necessary for your application, however, or you will overload the receiver and make things worse rather than better.

An alternative method is to make your own transformer by winding the primary and secondary windings on a ferrite (not powdered iron) toroid or bazooka-BALUN core. Ads in this magazine will help you locate sources. The ferrite cores have very high core permeabilities, so can be used to provide the significant inductances needed in the VLF bands with only a few turns of wire (10 to 50, rather than 200 to 2,000 turns!).

The alternative method is shown in Figure 5. This circuit uses the same amplifier at its core, but replaces the transformer with an L-C tuned circuit. The capacitor can be a 365 pF, 400 pF, 450 pF, or 550 pF broadcast variable. Or you can use a broadcast variable with a couple hundred picofarads shunted across it, if that's what you need. The inductor should match the capacitor for the

SIDEBAR A

VLF Radio Stations

FREQ (KHz)	CALLSIGN	OUTPUT (KW)	LOCATION				
15.1	HWU	250	LeBlanc, France	51.95	GYA	60	London, England
16.0	GBR	60	Rugby, England	53.5			Norway
16.4	JXN	100	Noviken, Norway	54.05	NBA	50	Balboa, Panama
16.8	FUB	250	Paris, France	55.5	GKH	100	Thurso, Scotland
17.1	UMS	1,000	Moscow, Russia	56.5	NPG		Dixon, CA, USA
17.4	NDT	50	Vosami, Japan	60.0	MSF	50	Rugby, England
18.1			Russia	60.0	WWVB	13	Ft. Collins, CO, USA
18.5	DHO	35	Flensburg, Russia	61.55			NATO
19.0	GQD	500	Anthorn, England	62.6			France
19.6	GBZ	350	Criggon, England	65.8	FUE	15	Brest, France
20.27	ICV	100	Tavolara, Russia	66.66	RBV	80	Moscow, Russia
21.4	NSS	400	Annapolis, MD, USA	68.0	GBY20	80	Rugby, England
22.3	NWC	1,000	Exmouth, Australia	68.9	XPH	25	Thule, Scotland
23.0	UTR3		Russia	71.0		2.4	Klenmond (Europe)
23.0	UQC3		Russia	73.6	CFH	250	Halifax, Nova Scotia
23.1			TACAMO (airborne)	75.0	HBG	20	Prangins, Switzerland
23.4	NPM	600	Lualualei, HI, USA	76.2	CKN	50	Vancouver, BC, Canada
24.0	NAA	1,000	Cutler, ME, USA	77.15	NAM	50	Norfolk, VA, USA
24.8	NLK	125	Jim Creek, WA, USA	77.5	DCF77	50	Mainflingen, Germany
25.0	UTR3		Russia	82.75	MKL	40	Petreavie, Scotland
25.0	UQC3		Russia	83.8	FTA83	45	St. Andre de Coroy, France
25.1	UTR3		Russia	85.0		2.4	Toww River (Europe)
25.1	UQC3		Russia	88.0	NSS	50	Annapolis, MD, USA
25.5	UTR3		Russia	91.15	FTA911	50	St. Andre de Coroy, France
25.5	UQC3		Russia	113.0		2.4	Piquetterur (Europe)
26.1	NPG	1,000	San Francisco, CA, USA	119.85	NPG	50	Dixon, CA, USA
26.1		200	TACAMO (airborne)	122.5	CFH	15	Halifax, Nova Scotia
27.1		200	TACAMO (airborne)	124.0	CKN		Vancouver, BC, Canada
28.5	NAU	100	Aquada, PR, USA	127.0		2.4	(Europe)
30.6	NPL	500	San Diego, CA, USA	128.25	NPL		San Diego, CA, USA
40.0	JG2AS	10	Chira, Japan	131.05	FUF	2	Martinique
44.0	VHB	200	Belconnen, Australia	133.15	CFH	15	Halifax, Nova Scotia
46.25	DCF46		Mainfligin, Germany	134.0	NSS	100	Annapolis, MD, USA
48.5	NXL(?)	110	Jim Creek, WA, USA	135.95	NPG	50	Dixon, CA, USA
50.0	MA50	7	Poderady, Czech Rep	137.0	CFH		Halifax, Nova Scotia
50.0	RTZ		Irtutsk, Russia	146.1	NPM	20	Lualualei, HI, USA
51.6	NSS	200	Annapolis, MD, USA	148.2	NPL	25	San Diego, CA, USA
				252	Eire	1000	Ireland

OMEGA Navigational System operates in the range 10 to 14 KHz. Four primary frequencies are 10.2, 11.05, 11.33, and 13.6 KHz. Not broadcasting continuously: 15.1, 23.0, 23.1, 25.0, 25.1, 25.5, 26.1, 27.1, 50.0 (RTZ), 61.55, 62.6, 65.8, 66.66, 83.8, and 91.15 KHz.

Open Channel

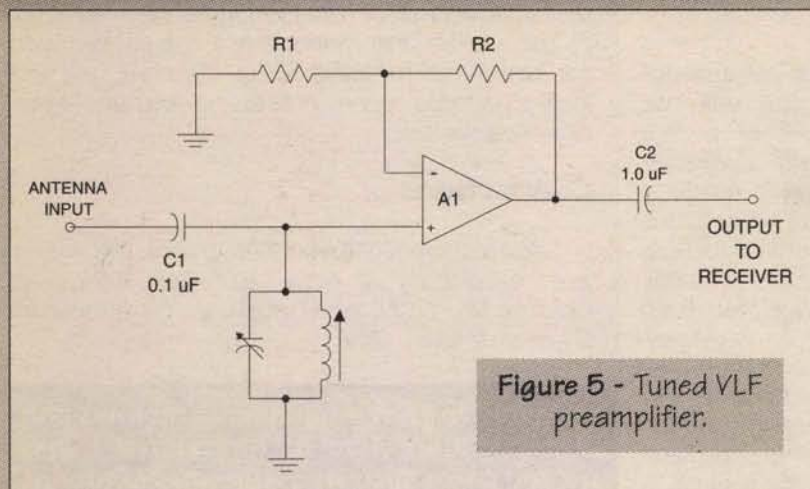


Figure 5 - Tuned VLF preamplifier.

frequency that you wish to receive; values in the range 4 to 80 mH are common.

Two capacitors are used in this circuit. The input capacitor is a 0.1 μF unit, and can be any type of capacitor that you desire. The output capacitor (C2) is also used in Figure 4 (where it is called C1), and should be one of the non-electrolytic types, even though it is 1.0 μF .

The gain for this circuit is set using a similar equation to the previous circuit, but without the transformer turns ratio:

$$A_v = \left(\frac{R_2}{R_1} + 1 \right) \quad (2)$$

In both Figures 4 and 5, the power supply connections are not shown. Most operational amplifiers will have two supplies needed: a V+

supply (typically +12 volts) and a V- supply (typically -12 volts). Other operational amplifiers only need one DC power supply connection plus a ground. It is also possible to use a dual polarity op-amp in a single polarity circuit if the right external circuitry is provided. In any case, bypass the DC power supply terminal to ground with a 0.1 μF to 1.0 μF capacitor mounted as close as possible to the body of the op-amp.

Additional VLF Phenomena

In this column in the past, we've discussed whistlers and spherics, as well as the signal enhancement effect seen in the VLF band due to solar flares and Sudden Ionospheric Disturbances (SIDs). However, there are some additional phenomena that have been noted.

Non-reciprocal Propagation. Radio propagation is normally reciprocal, i.e., it is the same in both directions between any two points. The reason for this is that the atmospheric conditions between the two points is the basic issue (see my articles on propagation last two months). But occasionally an anomaly is noticed in which A→B propagation is not the same as B←A. This occurs over very long distances at ELF (under 1000 Hz). I've seen this affect the medium-wave bands as

well. It's well known that ham operators on the East Coast of the USA can hear European hams who cannot, in turn, hear them.

Schumann Resonance. One of the things that makes VLF and ELF reception different from the other bands is that the wavelengths of the signals approximate the distance between the surface of the earth to the bottom of the ionosphere. As I understand this phenomenon, the cavity between the surface of the earth's spherical shape and the bottom of the heavily ionized D-layer forms resonances at about 8 Hz, 14 Hz, and 20 Hz. Propagation of electromagnetic signals at these frequencies can be very efficient, according to the Schumann Resonance Theory. The source of these signals apparently is lightning strikes.

Anomalous Signal Increases. The nighttime propagation in any band is considerably different from the daytime performance because of the ionization of the upper reaches of the earth's atmosphere. It appears that signals in the 40 to 80 Hz, and 150 Hz region can undergo rapid changes of up to 10 dB over a period of several hours, when conditions on other frequencies are relatively calm. This sounds like a spurious report to me, but I would be interested in hearing reports from anyone who has actually observed them, or has a good scientific article on the topic (see "Connections ...").

VLF Products Source

Recently I saw a catalog that should interest

SIDEBAR B

References

- Aarons, Jules, 1965, *Solar System Radio Astronomy*, New York: Plenum Press.
- Akasofu, S.I., 1989, "The Synoptic Aurora," *Scientific American*, May 1989.
- Amslie, A.G., 1987, "Explosions in the Solar Atmosphere," *Astronomy Now*, November 1987.
- Barden, William, Jr., "Use Your Computer as a High Speed Oscilloscope," *Science Probe!*, July 1992, p. 113.
- Bone, N., 1988, "The Aurora," *Astronomy Now*, February 1988.
- Carr, Joseph J., 1994, "Simple Very Low Frequency (VLF) Receivers," *Communications Quarterly*, Winter 1994, pp. 69-77.
- Carr, Joseph J., *Receiving Antenna Handbook*, Solana Beach, CA: HighText.
- Carr, Joseph J., "Small Loop Antennas - Part 1," *Communications Quarterly*, Winter 1992/93.
- Carr, Joseph J., "Small Loop Antennas - Part 2," *Communications Quarterly*, Spring 1993.
- Carr, Joseph J., 1992, *The Art of Science: A Guide To Experiments and Handling Data* (Hightext Publications; see Gazelle catalog in UK).
- Carron, L. Peter Jr., *The World Below 500 Kilohertz*, Reynoldsburg, OH: Universal Radio Research.
- Cornell, Ken, 1991, *The Low and Medium Frequency Radio Scrap Book*, Seventh Edition, Point Pleasant Beach, NJ: Self-published by the author.
- David, Erwin, 1991, *HF Antenna Collection*, Radio Society of Great Britain (Potters Bar, Herts., UK).
- DeMaw, Doug, "His Eminence the Receiver - Parts 1 and 2," *QRP Classics*, Newington, CT: ARRL (originally published in *QST* for June and July 1976).
- Eggleston, Gary, "The Sky Chorus," *Popular Electronics*, July 1993, p. 46.
- Espenak, Fred and Jay Anderson, *The Annular Solar Eclipse of 10 May 1994*, NASA Reference Publication No. 1301.
- Forgey, G. William, 1994, Private correspondence with author. The Mark III receiver is presented with permission of Mr. Forgey, 25 Jan 1994.
- Foukal, P.V., 1990, "The Variable Sun," *Scientific American*, February 1990.
- Hayward, Gordon VE3EOS. Correspondence to the author (n.d., received 3 June 1994).
- Helms, Harry, "Secret Information from WWV," *Popular Communications*, January 1993, p. 37.
- Isernring, Harold, "WWVB Signal Processor," *Ham Radio*, March 1976, p. 28.
- Jacobs, George and Theodore J. Cohen, 1979, *The Shortwave Propagation Handbook: Principles, Theory, Prediction*, Hicksville, NY: CQ Publishing, Inc.

- Johnston, Kenneth and Marvin E. Johnston, "An Eclipse Study on 80-Meters," *QST*, July 1979, p. 14.
- Jones, E.W., Jr., 1986, *Scientific American*, March 1986.
- Kennedy, Jim, John Schauble, Jerry Allnoch, and Don Roberts, "D-Layer Absorption During a Solar Eclipse," *QST*, July 1972, p. 40.
- Leary, Thomas P., "An Electronic Storm Finder," *QST*, June 1964, p. 23. Additional comment on this same article; see also technical correspondence from E.O. Johnson in *QST* April 1971, p. 49, and from A. Smith, *QST* July 1971, p. 55.
- Lewis, David K., "Effects of a Solar Eclipse on the Ionosphere," *QST*, January 1979, p. 26.
- Lichtman, Jeffrey M., "Signals from the Cosmos," *Science Probe!*, July 1991, p. 51.
- Marris, Richard Q., "A Multi-Purpose Signal Monitoring Meter," *Short Wave Magazine* (UK), May 1993, p. 28.
- McIntosh, Patric S. (ed.) and Murray Dryer (ed.), 1972, *Solar Activity Observations and Predictions*, Cambridge, MA: MIT Press.
- Menzel, Donald H., "A Total Solar Eclipse and Radio Propagation," *Technical Correspondence*, *QST*, September 1976, p. 30.
- Mideke, Michael, "The May 10, 1994 Annular Eclipse," *Natural Radio News*, *The Lowdown*, August 1993.
- Mideke, Michael, "VLF Spectrum Analysis," *The Lowdown*, September 1993.
- Mideke, Michael, "Listening to Nature's Radio," *Science Probe!*, July 1992, p. 87.
- Mideke, Michael, personal letter dated 17 July 1993, in author's files.
- Mideke, Michael, "Modifying the RS-4 Receiver for Loop and Remote E-Field Inputs," n.d., a monograph privately published by Mideke.
- Mideke, Michael, "A Whistler Hunter's Guide," n.d., a monograph privately published by Mideke. This publication is available for \$6.00 in USA postpaid (slightly more overseas). It contains two receiver construction projects for intercepting electromagnetic VLF "whistlers" - natural radio signals - in the 1 to 10 KHz band. Mideke can be reached at P.O. Box 123, San Simeon, CA 93452 USA.
- Mideke, Michael, *Introduction to Natural Radio*, a 60 minute cassette tape of natural radio signals heard in the 1 to 10 KHz band, along with some sources of interference. Annotated with voice. \$10.00 postpaid in USA (slightly more overseas). Mideke can be reached at P.O. Box 123, San Simeon, CA 93452 USA.
- Miller, Richard W., "Sunspots, Flares and HF Propagation," p. 198.
- Mims, Forrest III, "Project Halo: The Annular Solar Eclipse of 1994," *EOS, Transactions of the American Geophysical Union*, Vol. 74, No. 18, 4 May 1993, p. 209.
- Okada, Toshimi and Akira Iwai, 1988, *Natural VLF Radio Waves*, Letchworth (Herts.), UK: Research Studies Press/Wiley.
- Petrzellis, Tom L., 1993, "Aurora Monitor," *Electronics Now*, Sept. 1993, p. 66.

continued

Open Channel

VLF research and listening fans. It comes from LF Engineering Company, 17 Jeffry Road, East Haven, CT, 06473; phone **203-248-6816**. I ordered a catalog from them from an ad in *Lowdown*, and found a number of interesting converters, receivers, and antennas offered for sale.

World Wide Web VLF/RadioScience Activity

Now that I have America On-Line, I've been surfing the Internet's World Wide Web. There is a considerable amount of information of interest to VLF and other radioscientific observing fans. Use keywords such as "NASA," "Very Low Frequency," "VLF," and "Radio" to locate the URL addresses for the various pages. The Whistler Hunter's "Project Inspire" have a page on the NASA WWW Home Page. Also, some of this material is also found in the "Science Education" keyword.

In the Future ...

Although many people doing radioscientific and other science hobby observing will use mechanical recorders (as covered here a few months ago), others will use a digital computer for recording and logging signals. It's relatively easy to pick up MS-DOS computers with simple monitors and 40 megabyte hard drives for less than \$100.00 today (I've seen them for \$40.00). These computers are good enough for such recording, even though they don't run Windows. An advantage of those computers is that they can be left running all the time, and don't represent a huge financial loss if a passing thunderstorm puts transient spikes on the line and thereby wipes out the computer (I turn my super 4.6-gbyte computer off during storms!).

One thing that seems lacking in much of the coverage of science activities is the analog front-end. The computer speaks binary, but the rest of

the world is analog. The analog front-end processes the signals and makes them compatible with the computer. In some future columns, we will look at analog signal processing and analog-to-digital converters.

Connections ...

You can reach me either c/o of this magazine, or directly at either P.O. Box 1099, Falls Church, VA 22041 (snail mail), or carrj@aol.com (Internet E-Mail). **NV**

Joe has written a lot about antennas and propagation. Two of his related books are *Joe Carr's Receiving Antenna Handbook* (HighText, \$19.95, 1-800-247-6553), and *Practical Antenna Handbook* (TAB/McGraw-Hill, \$26.95, 1-800-233-1128).

Construction project for a magnetometer instrument.

Pine, William, Instructional materials prepared for INSPIRE, High School Support for Space Physics Research, October 1991.

Saveskie, Peter N., 1980, *Radio Propagation Handbook*, Blue Ridge Summit, PA: TAB Books.

Schellenbach, R.R., "Eclipse Experiment-1970," *QST*, July 1970, p. 32.

Schneider, David, 1994, "Mother Nature's Radio," *QST*, January 1994, pp. 49-51.

Sickles, Robert O., "Detection of Solar Flares by the Hudak Shortwave Fadeout Method," a discussion of winning science fair project of Miss Jennifer Lieber, *The Radio Observer*, #70, April 1993, Fort Pierce, FL, USA.

Smith, Roy E., "Beacons Provide Eclipse Propagation Data," *QST*, July 1979, p. 16.

Steele, Russell, "Amateur Scientist Maps Milky Way Galaxy," *Science Probe*, July

1992, p. 49.

Stokes, Arthur and Peter O. Taylor, "A Tuning Coil Modification of Our VLF Receiver," *SID Technical Bulletin*, American Association of Variable Star Observers — Solar Division.

Taylor, Peter O. and Arthur Stokes, "Recording Solar Flares Indirectly," *Communications Quarterly*, Summer 1991, p. 29.

Taylor, Peter O., "The Solar Spectrum," *Communications Quarterly*, Winter 1992, p. 46.

Taylor, Peter O., "The Solar Spectrum," *Communications Quarterly*, Spring 1993, p. 51. Article contains a discussion of modifications to AAVSO receiver designed by A. Stokes.

Watt, A.D., 1967, *VLF Radio Engineering*, Pergamon Press.



- PRODUCT ENGINEERING
- FIRMWARE DEVELOPMENT

**"QUALITY
IS OUR
CAPITAL
CONCERN."**

**Complete On Site
Electrical Engineering Lab**

- REVERSE ENGINEERING
- RF CIRCUIT DESIGN & MANUFACTURING

- MICRO CONTROLLER & EPROM HARDWARE & SOFTWARE DEVELOPMENT

From Auto-Routing to CNC Routing to Electronic Assemblies...
Capital Electronics is Your Best Route For Printed Circuit Boards.

DESIGN/LAYOUT

- CAD LAYOUT SERVICES
- COMPATIBLE WITH ALMOST ALL CAD SYSTEMS
- FROM SCHEMATICS OR SAMPLE PCB'S
- PHOTOPLOTTING SERVICES
- 28,800 BAUDE MODEM

PRINTED CIRCUIT BOARDS

- SINGLE & DOUBLE SIDED
- MULTI-LAYER & FLEXIBLE PCB'S
- FROM QUICK TURN PROTOYPES TO SCHEDULED PRODUCTION RUNS
- FINE LINES, SMT
- ELECTRICAL TESTING
- PRECIOUS METAL PLATING

ASSEMBLY SERVICES

- FAST TURN BOARD STUFFING
- WIRE HARNESSES
- WAVE SOLDERING
- ACQUISITION OF PARTS
- FINAL TESTING
- TURNKEY SERVICES
- CUSTOM ENCLOSURES

**For Quick & Competitive Pricing or More Information,
Please Call Us Today!**

852 Foster Avenue • Bensenville, IL 60106

(708) 350-9510

Fax (708) 350-9760 • Modem (708) 350-9761

Internet Access:

For Automated Info Response:
INFO@capital-elec.com

E-Mail: Quote@capital-elec.com

Web Access: <http://www.capital-elec.com>

GUARANTEED
PRICES
FROM:
\$14.00
TO
\$49.95

SUPER CABLE TV TURN-ON MODULES

CUSTOM MANUFACTURED FOR EXCELLENCE!!

TEST YOUR CABLE BOX FOR OPTIMUM PERFORMANCE

Excellent Detailed Instructions • Complete With Illustrations

STAR-6 • STAR-7 • CF-SERIES

P5-D & PV5-D

PV7-D & PBB7-D (Including R or V Models)

NEW 1 Wire Smart Board Available

CF-Series

NEW 1 Wire Smart Board Available

EASY 5 MINUTE INSTALLATION

FULLY ASSEMBLED & TESTED

DISGUISED OPERATION

TECHNICAL SUPPORT

ONE YEAR REPLACEMENT
WARRANTY

T.C. SERIES

03V & 07

PIONEER MODULES

BA-5100 thru BA-6150

BA-6300 thru BA-6700

SCIENTIFIC ATLANTA SMART BOARDS

8500 Dual Module

8530 Dual Module

8535 Dual Module

8536 Dual Module

8550 Smart Board

8570 Smart Board

8580 Smart Board

8590 Smart Board

8600 Smart Board

ZENITH Z-TAC MODULES

ST-1000 thru ST-5612

MASTER COMPONENTS (800) 233-0570

HAM GEAR FOR SALE cont.

QSL CARDS designed for you, SASE for sample. 8750 La Entrada, Whittier, CA 90605. E-Mail Bob.Schneider@monkey.monkeybarrel.com

REPEATER CONTROLLERS complete wired, tested, \$80. Crawford Amateur Radio Society, PO Box 653, Meadville, PA 16335.

MAXON GMRS 2 to 5 watt 10 channel handheld. 50 CTCSS tones, programmable, scan modes, repeater capable. Many other features. We have this new model 210+3 in stock, along with all accessories. We have the lowest prices and shipping rates! For info and orders, write or call: **Sports-Comm**, PO Box 36, Scotts Mills, OR 97375. 1-800-573-2256. Hours 9-5 Pacific Time, M-F.

PROGRAMMABLE COUNTER. Works with ANY VFO rig! Get a digital display for your rig, 100Hz resolution. You can read the tuned frequency directly, no need to calculate offsets. Counts to 40MHz, up OR down. Counter Kit \$69.95. Kit w/case \$99.95 Assembled w/case, \$139.95. S&H \$6 (Continental US). GUARANTEED TO WORK. For info send **SASE**. Call/write to order: S&S Engineering, 14102 Brown Road, Smithsburg, MD 21783. 301-416-0661.



THE SMART BATTERY CHARGER for lead acid or gel cell batteries. Can be left connected to the battery INDEFINITELY, will not overcharge! Standard kit is 12V @ 1 amp. This kit is 100% complete, including a custom-made, pre-punched, painted and lettered enclosure. For the kit order #150-KIT at \$59.95. For an assembled and tested unit, order #150-ASY at \$79.95. CA residents add 7.75% sales tax. Add \$6.50 per unit shipping. MC/VISA accepted. A&A Engineering, 2521 W. La Palma #K, Anaheim, CA 92801. 714-952-2114, FAX 714-952-3280.

REPEATER CONTROLLER on a chip \$24.95 + \$5 S/H. PC board available. Ambient Systems, POB 14183, Gainesville, FL 32604-2183. 352-371-7694 ambient@afn.org

JVFAX HAMCOM interface xmit and rec includes shareware JVFX7.1 HAMCOM 3.0 Pakmon 1.0. Modes Wefax, Color Ham Fax, Color SSTV, CW, RTTY, AMTOR. (Packet rec only) \$24.95, \$4.50 S&H (in plastic case). Send #10 SASE for catalog. New address. A&L Engineering, PO Box 226, Montgomery, IL 60538-0226.

SEND RECEIVE CW, RTTY, Amtor, WeFax, SSTV with Hamcom interface. Assembled board & shareware disk \$29.95 + \$5 S/H. Unpopulated board & disk \$7 + \$3 S/H. Ambient Systems, POB 14183, Gainesville, FL 32604-2183. 352-371-7694. ambient@afn.org

HV RECTIFIERS! Excellent replacement of diode strings, tubes in power amplifiers, etc. New. 10,000 volts @ 1 amp. \$8 each. 16,000 volts @ 1 amp. \$12 each. Add \$3 for shipping. A. Williams, Box 201, East Flat Rock, NC 28726-0201.

R390A RECEIVER w/manuals great military receiver casing Ham Bands \$325. Manuals alone could cost \$100-\$150 from retail sources. Phone 714-458-7007 Laguna Hills, CA.

MANUALS FOR AMATEUR, AUDIO, AND RADIO-RELATED EQUIPMENT. High quality is customer priority. Two \$32 stamps for catalog. Pete Markavage, 27 Walling St., Sayreville, NJ 08872-1818. 908-238-8964.



MORSE CODE Computer Interfaces \$49.95 with CW Filter \$79.95 plus \$3 shipping. Free Ham and IBM Shareware Catalog. Dynamic Electronics, Box 896, Hartselle, AL 35640, E-Mail dei@whnt19.com 205-773-2758, FAX 205-773-7295.

ICOM COMMERCIAL bought, sold, repaired, warranty. Specials: Sales demo F30LTs w/slow charger \$400 (have 8). Stubby ducks F30/40/LT \$22. New lower prices on F30/40 series w/chargers. 99 channel text upgrade for early F30/40/LT free. SWS Security 410-879-4035.

MOTOROLA HTs for sale. Two very small Motorola Handie-Talkies 450MHz Model HT100 with leather cases and Motorola Instruction Manual \$155 including shipping. 307-632-3217.

MOTOROLA AND commercial radios for sale. Motorola Syntor VHF, 60W, w/8 channel Systems90 scan and control head, programmed w/access. \$175; Motorola SyntorXX VHF, 100W, 64 ch. w/12 ch. rotary control head, programmed, w/access. \$250; ICOM IC-125 VHF, 30W, 5 ch. user programmed diode matrix with programming chart, \$100. Many other radios call for info. Sorry, my stock changes so fast I can't send out a list. J&H Comm., 916-334-8473.

Subscribe to Nuts & Volts Today!

HAM GEAR WANTED

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Now selling memory. We can beat any printed price in Nuts & Volts. Call 1-800-4-MEMORY now! Voice/FAX.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-842-5953, FAX: 818-845-3613.

SOFTWARE PROGRAM for Motorola Max Trac 50 tune into 444.000 ham band and UHF pre-amp for Mocom 35 to fit inside radio for 444.000. Dan KQ8G, 23123 Lawrence, Dearborn, MI 48128.

WANTED: COLLINS mechanical filters for 455KHz IF and 2.1KHz to 2.7KHz bandwidth. Ray Megirian K4DHC, 954-427-1980, 606 SE 6th Avenue, Deerfield Beach, FL 33441.

WANTED: VINTAGE audio components, tubes, catalogs, record cutting lathes, Tektronix 570, tube testers, etc. 612-869-4963.

DOOR KNOB CAPACITORS

(some in limited quantity)

25pF, 7.5KV 7/8" x 3/4" dia. \$12.99	470pF, 15KV 1" x 3/4" dia. \$15.99	2700pF, 40KV 1-1/2" x 2-1/4" dia. \$39.99
HI-Q ACO ±10% NPO	Sprague 715C-Z	Sprague 715C
33pF, 7KV 1-3/4" x 1-1/8" dia. \$19.99	500pF, 5KV 1-5/8" x 1-1/8" dia. \$29.99	3300pF, 40KV 1" x 2-1/8" dia. \$69.99
HEC 913-1425-000 NPO 8417	ITT Jennings JHT57 10% N3300	CM 4423238
35pF, 5KV 7/8" x 3/4" dia. \$12.99	500pF, 5KV 7/8" x 3/4" dia. \$12.99	.0001mfd, 3KPVW 1-1/8" x 1" sq. \$29.99
HEC HT50 ±5% NPO 913	CRL858 ±20% XST 917	Sangam Type 271 .75A RMS at 1000KC
40pF, 5KV 1/2" x 5/8" dia. \$12.99	500pF, 10KV 7/8" x 1" dia. \$12.99	27130B101J02
CRL853 N750	HI-Q Aerovox	.0005mfd, 30KPVW 4" x 3-1/2" dia. \$79.99
40pF, 7.5KV 7/8" x 3/4" dia. \$12.99	500pF, 10KV on a plate 3-1/4" sq. \$29.99	Sangam Type 294 12A RMS at 1000KC
CRL850 5% NPO	Thermal MS-2C DCT	294300B501J00
50pF, 5KV 7/8" x 3/4" dia. \$12.99	500pF, 10KV on a plate 3-1/4" sq. \$39.99	.01mfd, 2KPVW 1-3/8" x 1-1/4" sq. \$29.99
CRL850S NPO	Thermal MS-1C DCT	Sangam Type 272 11A RMS at 1000KC
67pF, 7.5KV 7/8" x 3/4" dia. \$12.99	500pF, 20KV 1-1/8" x 1" dia. \$39.99	27220B103J00
CRL850 5% NPO	Sprague 20DK-T5	.01mfd, 10 KPVW 5" x 3-1/2" dia. \$49.99
100pF, 14KV 2" x 2-3/4" dia. \$69.99	500pF, 30KV 1-1/4" x 1-1/2" dia. \$39.99	Acushnet Type 1981 ±5% 18A at 100KHz
10KVA ±20%	Erie CHV411P101 ±20%	.01mfd, 20KVDW 6-3/4" x 1-5/8" dia. \$29.99
120pF, 2.5KV 7/8" x 3/4" dia. \$12.99	500pF, 30KV 1-1/4" x 1-1/4" dia. \$39.99	The Condenser Products Corp.
HEC HT50 913-0843-00 ±5% and	Sprague	CP103 20MX
CRL850 913-0843-00	1300pF, 40KV 1-6/8" x 2" dia. \$39.99	.012mfd, 1KPVW 1-1/8" x 1" sq. \$29.99
200pF, 2.5KV 7/8" x 3/4" dia. \$12.99	Sprague	Sangam Type 271, 10A RMS at 1000KC
CRL850 N750	1300pF, 40KV 1-1/2" x 1-3/4" dia. \$39.99	27110B123J02
460pF, 30KV 1-1/4" x 7/8" dia. \$39.99	Sprague 715C-Z	.062mfd, 2KPVW 2-1/2" x 2-1/2" dia. \$29.99
4612 506A		Sangam Type 292, 39A RMS at 1000KC

MC, VISA, American Express, COD Cash Only
Electronic Emporium, Inc., 3621 E. Wier Ave., Phoenix, AZ 85040
Phone: 602-437-8633 • FAX: 602-437-8835

Write in 215 on Reader Service Card.

Nuts & Volts Magazine/March 1996 11

CHEEK

The Ultimate Scanner!

There's only one BEST!

The King of Scanners takes this step-by-step, richly illustrated, bench manual beyond everything ever printed on scanner mods. Bill is a perfectionist who will help you convert your scanner into precisely what you've always wanted!

May 1995

244 pages, large format, \$29.95.

Cheek's Scanner Modification Handbooks Vol 1: 160 pgs. Vol 2: 220 pgs, both large format & \$19.95. Best Sellers for years!

Monitor America ESSENTIAL!

Federal/state/local frequencies, with super detail. Everything you need! 800+ pages, \$24.95

Scanners & Secret Frequencies

Henry Eisenson's best seller. Novice to pro, it's MUST reading. Highly praised by the experts. 320 pages, \$19.95

Emergency Radio! Norm Schrein Scanning news as it happens. FUN! 214 pages, \$14.95

Television Gray Market

How they steal cable programming! Eisenson, 160 pages, \$23.75

Index Publishing Group, Inc. 1st book: \$4.95
3368 Governor Dr, Ste 273N Add'l: \$2 ea
San Diego, CA 92122 CA: add
7.75% tax
1-800-546-6707 - credit cards

Write in 206 on Reader Service Card.

SURPLUS TEST EQUIPMENT

HEWLETT PACKARD

11664A, Detector	\$325
11664C, Detector	\$150
1630A, Logic Analyzer	\$700
1630D, Logic Analyzer	\$800
1630G, Logic Analyzer, 65 Channel	\$1200
1725A, 275MHz Oscilloscope	\$500
1740A, Oscilloscope, 100MHz	\$300
1741A, 100MHz Storage Oscilloscope	\$450
182T/8755C, Sweep Amplitude Analyzer	\$850
1980B, Measurescope w/1950A Plug-in	\$800
214B, Pulse Generator, 200 Watt	\$1200
3310A, Function Generator	\$250
3310B, Function Generator, .0001Hz-5MHz	\$250
3311A, Function Generator, .01Hz-1MHz	\$225
3312A, Function Generator, .1Hz-13MHz	\$850
3325A, Synthesizer/Function Generator, 1UHz-20.999MHz	\$2300
3325A, Synthesizer/Func. Generator w/opt. 002	\$2550
3335A, Synthesizer/Generator, 200Hz-80MHz	\$4000
334A, Distortion Analyzer	\$350
3455A, Digital Voltmeter	\$400
3456A, Digital Multimeter, 6.5 Digits	\$800
3468B, 3.5 Digit Multimeter	\$250
3490A, Digital Multimeter	\$75
3562A, Signal Analyzer	\$14,500
3575A, Phase Gain Meter 1Hz-13MHz	\$1000
3580A/ANALOG, Spectrum Analyzer, 5Hz-50KHz	\$1200
3581A, Wave Analyzer	\$500
3581C, Selective Voltmeter	\$800
4145A, Semiconductor Parameter Analyzer	\$10,000
4192A, LF Impedance Analyzer	\$13,000
4261A, LCR Meter, 120Hz-1KHz	\$1200
4262A, LCR Meter	\$2000
4271B, LCR Meter, 1MHz	\$1500
428B, DC Ammeter w/Probe	\$200
435A, Power Meter	\$250
4800A, Vector Impedance Meter	\$800
4815A, Vector Impedance Meter	\$1000
5314A, Frequency Counter, 10Hz-100MHz	\$200
5315B, Universal Counter, DC-100MHz	\$300
5316A, Universal Counter, DC-100MHz	\$600
5328A, Universal Counter, DC-100MHz	\$225
5328B, Universal Counter	\$1750
5335A, Frequency Counter, opt. 10/20	\$1450
5340A, Frequency Counter, 10Hz-18GHz	\$800
5342A, Frequency Counter, 0.5-18GHz	\$2250
5345A, Universal Counter	\$750
5359A, Time Synthesizer	\$2850
54110D, Color Digitizing Oscilloscope	\$4500
6002A, Opt. 01, Power Supply, HP-IB, 0-50V/0-10A	\$800
6114A, Precision Power Supply, 0-20V/0-2A	\$550
6227B, Dual Power Supply, 0-25V/0-2A	\$600
652A, Test Oscillator, 10Hz-10MHz	\$200
7090A, Measurement Plotting System	\$2250
71200A w/70310A, Spectrum Analyzer, 50KHz-22GHz w/Precision Frequency Reference	\$24,000
7475A, 6 Pen Graphic Plotter	\$250
7550A, Plotter	\$200
8007B, Pulse Generator, 100MHz	\$550
8012B, Pulse Generator, 50MHz	\$750
8013B, Pulse Generator, 1Hz-50MHz	\$750
8111A, Pulse/Function Generator, 20MHz	\$1850
8165A/01/02, Signal Source	\$2750
8349B Amplifier, 2-20GHz	\$4000
8350A, Sweep Oscillator Mainframe	\$2400
83540A, 2.0-8.4GHz RF Plug-in	\$2250
83540B, RF Plug-in, 2.0-8.4GHz	\$4750
83545A, Oscillator Plug-in, 5.9-12.4GHz	\$4200
83572B/001-006, Oscillator Plug-in, 26.5-40GHz	\$12,000
8405A, Vector Voltmeter 1MHz-1GHz	\$250
8410B, Network Analyzer System w/8412A, 8743A & 8411A	\$600
8411A/018, Frequency Converter .11 to 18GHz	\$500
8443A, Tracking Generator/Counter	\$350
8445B, Automatic Prescaler	\$450
8447A, Amplifier, 0.1-400MHz	\$300
8447B, Amplifier, 0.4-1.3GHz	\$350
8447C, Amplifier, 30-300MHz	\$300
8501A, Storage Normalizer	\$700
8505A, Network Analyzer	\$2500
8505A/8503A/8501A, Network Analyzer System w/S-Parameter Test Set & Storage Normalizer	\$4750
853A, Display for Spectrum Analyzer Plug-in	\$2250
8552B, IF Section Plug-in	\$600
8552B & 8553B, Spectrum Analyzer w/141T Mainframe	\$1500
8552B & 8555A, Spectrum Analyzer w/141T Mainframe	\$1800
8557A/182T, Spectrum Analyzer .01-350MHz	\$1600
8559A W/182T, Spectrum Analyzer, 0.01-21GHz	\$3500
8565A, 10MHz-22GHz Spectrum Analyzer	\$4500
8569B, 10MHz-22GHz Spectrum Analyzer, Microprocessor Based	\$8000
86290A, RF Plug-in, 2-18GHz	\$1800
86290B, RF Plug-in, 2-18.6GHz	\$2000
8640B, Signal Generator, 0.5-512MHz	\$1500
8640B, Signal Generator, Opt. 002, 5-1024MHz	\$2500
8654A, Signal Generator, 10-520MHz	\$650
8654B, Signal Generator, 10MHz-520MHz	\$800
8660C/100, Synth. Signal Generator	\$1350

86601A, RF Plug-in, .01MHz-110MHz	\$350
86602B, RF Plug-in, 1-1300MHz	\$650
86603A, RF Plug-in, 1-2600MHz	\$1500
8660C Opt. 100, Signal Generator, 1-1300MHz w/86602B RF Plug-in & 86632A Mod. Plug-in	\$3000
8684B, Signal Generator, 5.4-12.5GHz	\$2000
8753A w/85046A, Network Analyzer, 300KHz-3.0GHz w/S-Parameter Test Set	\$18,000
8754/H26, Network Analyzer, 1-2600MHz	\$3200
8756A, Network Analyzer	\$2850
8901B, Modulation Analyzer	\$12,000
8903A, Audio Analyzer, 20Hz-100KHz	\$3000

HUNDREDS OF POWER SUPPLIES IN STOCK. CALL FOR SPECS.

TEKTRONIX

11A32, Two Channel Amplifier, DC to 400MHz	\$1850
1240/D1/D2, Logic Analyzer, 27 Channel	\$1350
465, Oscilloscope, 100MHz	\$400
465B, Oscilloscope, 100MHz	\$550
475, 200MHz Oscilloscope	\$650
475A, 250MHz Oscilloscope	\$800
485, Oscilloscope, 350MHz	\$900
577 D2, Curve Tracer w/177 Fixture	\$1700
7104, 1GHz Mainframe W/2) 7A29, 7B10, 7B15	\$4500
7B92A, Delaying Dual Time Base to 500MHz	\$250
7D20, Programmable Digitizer	\$500
7L18, Spectrum Analyzer Plug-in, 1.5-18GHz Capable of 60GHz with Mixers	\$3000
AA5001, Programmable Distortion Analyzer	\$1750
FG502, 11MHz Function Generator	\$300
FG504, Function Generator Plug-in, .001Hz-40MHz	\$850
FG507, 2MHz Function Generator	\$975
OF150, Fiber Optic Cable Tester	\$2500
PG501, Pulse Generator	\$275
PG508, Pulse Generator Plug-in, 50MHz	\$600
S-4, Sampling Head	\$200
S-6, Sampling Head	\$275
SC503, 10MHz Storage Oscilloscope Plug-in	\$650
SC504, 80MHz Oscilloscope Plug-in	\$850
SC504, 80MHz Oscilloscope Plug-in	\$500
SG5010, Programmable Oscillator	\$1500
TR503, Tracking Generator for 492/4/5/6	\$1000

MISCELLANEOUS

ClaroStat 240C, Decade Resistor	\$100
Datron 4200, AC Standard	\$4250
Eaton 2052B, Amplifier, 100-512MHz	\$1000
Eaton 380K11, Synthesized Signal Generator	\$1300
Eaton PM360, AM Modulation Section	\$850
Eaton PM3602, AM/FM Modulation Section	\$1200
EH Research 122, Pulse Generator	\$350
EH Research 122A, Pulse Generator	\$650
EH Research 129, Pulse Generator	\$750
EH Research 137, Pulse Generator	\$250
ENI 406L, Amplifier, 150KHz-250MHz	\$800
ENI 411LA, Amplifier, 150KHz-300MHz, 10 Watt	\$1200
Fluke 335D, DC Voltage Standard	\$1250
Fluke 5100B/05, Multifunction Calibrator	\$6000
Fluke 5101B/03, Calibrator	\$7500
Fluke 5200A, AC Voltage Calibrator	\$2000
Fluke 540B, Transfer Standard	\$1200
Fluke 752A, Reference Divider	\$2500
Fluke 8505A, 6.5 Digit Digital Multimeter	\$400
Fluke 8506A, Digital Multimeter	\$1200
Gigatronics 605, Signal Generator, 6-18GHz	\$4000
Krohn-Hite 3100R, Tunable Filter	\$150
Krohn-Hite 3103/R3103, Tunable Filter/Rack Version	\$275/\$225
Krohn-Hite 3202/R3202, Tunable Filter/Rack Version	\$500/\$350
Krohn-Hite 3342, Tunable Filter	\$1000
LeCROY 9420, 350MHz Oscilloscope	\$1350
Sorensen QRD 30-1, Power Supply, 30V-1A	\$100
Sorensen QRD 40-2, Power Supply, 40V-2A	\$150
Wavetek 166, Pulse Function Generator	\$1200
Wavetek 178, Automatic Synthesizer	\$1850
Wavetek 186, Phase Lock Generator, 5MHz	\$400
Wavetek 2002, Signal Generator, 1-2500MHz	\$2000
Wavetek 2002A, Signal Generator, 1-2500MHz	\$1750
Wavetek 3000, Signal Generator, 1-520MHz	\$900
Wavetek 3000-200, Signal Generator	\$900
Wavetek 3001, Signal Generator 1-520MHz	\$1000
Wavetek 801, Pulse Generator, 5Hz-50MHz	\$800
Wavetek 802, Pulse Generator, 5Hz-50MHz w/Delay	\$600
Wavetek 907A, Signal Generator, 7-12.4GHz	\$850
Willron 560A, Scalar Network Analyzer	\$1850
Willron 6609, Sweep Generator, 10-2000MHz	\$4000
Willron 6659A, Sweep Generator, .01-26.5GHz	\$12,000

R & S Surplus

1050 E. CYPRESS STREET, COVINA, CA 91724

(818) 967-0846 • FAX (818) 967-1999



Prototype Plated Thru Circuit Boards

fast
turnaround!!

example
less than \$90 for two 5"x6" 2-layer boards

your order shipped next business day
if data is received by 7:00 AM



AP Circuits
#3-1112 40 AVE NE
Calgary, Alberta
Canada T2E 5T8
(403) 250-3408



for complete information download
newuser.exe from our 24 hr BBS
(403) 291-9342 (8N1)

Internet: <http://www.apcircuits.com>
Email: staff@apcircuits.com

Write in 176 on Reader Service Card.

WANTED: BS-8 pan display for Kenwood SM-220. Robert M. Dern KF8GK, 209 Primrose Dr., Martinsburg, WV 25401.

WANTED: ART-13 power plug U-7/U female pwr., cable plug. Steve Moore WB7BNZ, PO Box 589, Roslyn, WA 98941. 509-649-2913.

REPEATER MODULES wanted. Regency NCCU15RA 450-470 MHz, Motorola, General Electric, Uniden, VHF & UHF, ICOM Amateur Repeater Modules, 2 Meter, 220, 440MHz. All in working condition. John Supliski, 53 Hayward St., Yonkers, NY 10704. 914-969-1053 after 7PM EST.

CB/SCANNERS

CBs, ACCESSORIES, SCANNERS, ANTENNAS, MICROPHONES, COAX. Best prices! Call 1-800-821-2769 for current flyer. **THOMAS DISTRIBUTING**, 128 Eastwood, Paris, IL 61944.

SECRET CB Books 1-29, \$10 ea; Sams Books \$15 ea; RCI 2950-2970 service manual, \$10. Call for free catalog of other goodies, 1-800-536-0109.

SALES, SERVICE: CB equipment, radios, modifications, power mice, echo-reverb boxes, kits, meters, filters, antennas, noise toys, mounts, hard-to-find items. Partial list \$1, complete list \$4. D&R Electronics, 10 Park St., Thomaston, CT 06787. 203-283-9492.

SPECTRE

ELECTRONIC WARFARE BIBLE: Covering the entire spectrum of communications disruption of jamming. In-depth description of the basic principles, procedures, and jamming equipment used in this clandestine activity. Covers: Television and commercial radio stations, aircraft and airport communications, newswire services, shortwave radio, government and intelligence communications, CB radio, international frequencies, ham radio, and much more! Information never before made available to the public! Manual \$25. **SPECTRE PRESS**, PO Box 5112, N. Muskegon, MI 49445.

VINTAGE TUBE CBs. LSASE list. RFD 1, Box 75, Fort Kent, ME 04743. 207-834-6273, evenings/weekends.

THE RCI 2950/2970 service and modification handbook 100+ pgs. \$37, HR2510 handbk \$27, AR3300/3500 handbk \$27. Catalog \$3. Maxtech, Box 8086, New York, NY 10150.

CB & accessories, antennas as low as \$4.25. Meter 1KW \$29.95. Five digit frequency counter \$49.95. Six digit \$59.95. Radios, noise toys, expander, and much, much more. Call 1-800-713-3532 Visa, MasterCard only. Catalog will be shipped with your first order. West Coast Sales.

CB TUNE-UP MANUAL MASTER EDITION VOL. 7. Provides specific model instructions for channel modifications, clarifier conversion, peaking, repair tips, power modifications, 500+ microphone wirings. EAGLE 2000, EAGLE 5000, RCI2980, RCI2990, GALAXY DX33HML, DX44V, DX55V, DX99V, DX77HML, DX88HL, COBRA 148FGTL, UNIDEN GRANT and more. **FULLY ILLUSTRATED.** Send: \$26.95 + \$4 shipping or 1-800-821-2769 for orders only. Visa, MasterCard, Discover, or COD accepted. **THOMAS DISTRIBUTING**, 128 Eastwood, Paris, IL 61944.

TOMCAT'S BIG CB Handbook, by Tom Kneitel! 221 pages, illustrated. Everything they never told you about AM, SSB, DX, Freeband, legal and otherwise. Only \$15.95 (+\$5 postage, \$6 to Canada). CRB Research, Box 56, Commack, NY 11725. (NYS residents add \$1.73 tax). MC/Visa OK. Phone orders 516-543-9169.

PIONEER 6300 cable boxes w/remote and no E-4 modules, map switch, pretested in raw test mode, 1 yr. warranty, special \$195. Plo no E-4 PIC modules 5+ \$16 ea. Pio 6300 master files with serial # conversion Win 95 ver. \$250. PIC 16C54 no E-4 program with serial # \$200. PioWriter \$75. 7 days 7am-9pm PST. 702-892-9183.



RADAR/JAMMER This new x and k band active digital radar jammer works at any distance 100% of the time. Call 717-671-8650 for info or a brochure. For orders call 1-800-671-8117. **BLUE MOON GADGETS**, 6059 Allentown Blvd., #608, Harrisburg, PA 17112-0992. VISA/MC.

THE "WORLD Scanner Report" is for novice & expert radio hackers committed to excellence and rarity in the pursuit of VHF-UHF scanning. Edited and published by Bill Cheek, author of "The Ultimate Scanner" and Scanner Modification Handbooks. \$5/sample issue or SASE for details. Box 26247-N, San Diego, CA 92196; BBS/FAX, 619-578-9247, 5:30pm-1:30pm, voice-only 1:30pm-5:30pm, PST.

FEDERAL FREQUENCY Directory! Kneitel's "Top Secret" Registry of government Frequencies, New 8th Edition. 268 Pages! FBI, DEA, Customs, Secret Service, BATF, Immigration, Border Patrol, IRS, FCC, State Dept., Treasury, CIA, etc. & surveillance, bugs, bumper beepers, worldwide US military, 225 to 400 MHz UHF aero band, Canadian listings, & more. Ultimate "insider's" directory! Standard reference of law enforcement, news media, private security, communications industry & scanner owners. \$22.95 + \$5 shipping (\$6 to Canada). NY State residents add \$2.31 tax. CRB Research Books, Box 56-NVT, Commack, NY 11725. Visa/MC welcome. Phone orders 516-543-9169 weekdays (ex-Wed.) 10 to 2 Eastern.

DEVICE PROGRAMMERS



LOW COST
EPROM ERASERS



ADVANTECH
LABTOOL-48



NEEDHAM
SA-20



ROM MASTERS
SUPERPRO II



MOD-MCT-EMUPA

1249. ADVANTECH LABTOOL48	179. XELTEK ROM MASTER II	REFURB SPECIALS \$400 MOD-EMUPA \$300 MOD-EMUP \$300 SUPERPRO2 \$200 SUPERPRO \$400 SA-20 NEEDHAM \$300 PC-UPROG
669. EETOOLS ALLMAX PLUS	149. XELTEK ROM MASTER I	
596. ADVANTECH PC-UPROG	135. EETOOLS ROM MAX I	
569. MOD-MCT-EMUPA	189. EETOOLS ROM MAX 4	
429. XELTEK SUPERPROII	419. EETOOLS PROMAX	
689. NEEDHAM SA-20	49. SUNSHINE 1 GANG	
424. NEEDHAM EMP-20	125. SUNSHINE 8 GANG	



NEEDHAM
EMP-20



EETOOLS
ALLMAX PLUS

General Device Instruments MASTERCARD - VISA
 408-241-7376 Fax 241-6375 BBS 983-1234 E-Mail icdevice@best.com
 GDI Will Beat Any Price - Never Undersold - New Web Page!

Write in 98 on Reader Service Card.

ROGER BEEPS/KEYUP TONES single and multitone units. Kits and assembled. \$19.95 to \$29.95. For more information, faxed or mailed literature requests or orders please call **Daltronix**, 908-493-1658.

CELLULAR RESTORATION on your 800MHz scanner performed expertly for \$40 including return shipping. Guaranteed. Keith Perry, 607 Osage Dr., PO Box 816, Leander, Texas. Phone 512-259-4770.



HR2510 HOTTEST CB/10 meter rig going AM/FM/CW up to 80 watts SSB does not require chip change out! HR2510 with easy to follow instruction booklet. 1. How to add CB 26-30 MHz. 2. Convert rit to slider. 3. Boost up to 80 watts SSB. 4. Add variable power. 5. Add talk back. ONLY \$239.95 plus \$5 shipping. Video tape \$15 MO/COD (\$4.75 fee) DISC/VISA/MC. KDC SOUND, PO Box 8622, Grangerland, TX 77302. Order only 1-800-256-9895.

RESTORE FULL 800MHz CELLULAR. Very simple, new/old models. \$5 (include model #). **BRINKER ENGINEERING LABS**, Suite 125-A, Box 348, Ellaville, GA 31806-0348.

PAGERS. TONE only starting at \$5. Numeric pagers starting at \$12. Alpha starting at \$55. We also buy/sell new and used pagers. Credit cards okay. Write or fax 501-223-9406. **Software City**, Box 23016, Little Rock, AR 72221.

FREE IBM based DTMF decoding program and schematic VIA the Internet. Send E-Mail address to PDRUNEN@AOL.COM Request by mail, send check for \$6 to Concept Technology, 8700 Turkey Bluff Rd., Navarre, FL 32566.



ULTIMATE MODIFICATION BIBLE Vol. V NEWEST AND MOST COMPLETE. 1000 mike wirings CB and ham, 500 CB modulation boost, 200 CB PLLs, 200 ham radios, 30 scanner modifications. Over 200 pages. KDC Sound, PO Box 8622, Grangerland, TX 77302. Send \$29.95 or to order: 1-800-256-9895 COD (\$4.75 COD FEE), VISA, MC, DISCOVERY. OTHER CALLS; 409-321-3753.

240+ CHANNELS CB/ham radios AM/FM/SSB/CW export/domestic: RCI, Uniden, Galaxy, Cobra Superstar, mics, antennas, linears, modification kits, modulators, etc. Night scopes and tons more stuff. Catalog \$3. Maxtech, Box 8086, New York, NY 10150.

CB RADIO Hacker's Guide! Wow! Big 150 pages; pictorials, diagrams, text. Peaking, tweaking & modifying 200 AM & SSB CB radios. Improved performance, extra capabilities! Which screws to turn, which wires to cut, what components to add: Cobra, Courier, GE, Midland, Realistic, SBE, Sears, Uniden/President. \$19.95 plus \$5 shipping (\$6 Canada). NY State residents add \$2.06 tax. CRB Research, Box 56-NV, Commack, NY 11725. Visa/ MasterCard accepted. Phone order M-Tu-Th-F, 10-2 Eastern Time, 516-543-9169.

BROWNING GOLDEN Eagle Mark II w/D104 \$300 shipped. Browning LTD Mobile w/Cobra power mic \$100 shipped. Golden Eagle Mark III w/AM transmitter, w/Gold D-104 \$525 shipped. Siltronix model 90-3 VFO, \$100 shipped. Heathkit external speaker #SB600, \$60 shipped. Phone 405-657-3327 evenings.

READOUT CHANNEL Kit for Cobra 148, \$54.95; Modulation kits for RCI 2950, HR 2510, Galaxies, Cobras, Ranger 3300, plus more. Call 1-800-536-0109 for free catalog.

Don't miss a single issue!
 You can have *Nuts & Volts* delivered right to your door every month for only \$19.00 per year.
 Call 1-800-783-4624 and use your Visa or MasterCard.

LA PAZ Electronics International COMPUTER PARTS

DRAM SIMM

1Mx9-70 (3/9-chip) SIMM.....	\$30/32
4Mx9-70 SIMM.....	\$129
1Mx32/36-70 72-pin SIMM(4MB).....	\$95/139
2Mx32/36-70 72-pin SIMM (8MB).....	\$189/239
4Mx32/36-70 72-pin SIMM (16MB).....	\$391/455
256Kx4-70 DIP DRAM.....	\$5.50
1Mx1-70/80 DIP DRAM.....	\$5.35/5.00
1Mx4-80 DIP/ZIP DRAM.....	\$29.50/22.00
256Kx8-60 VIDEO SOJ DRAM.....	\$21.00
256Kx16-70 VIDEO ZIP..(2CAS/2WE).....	\$20.50/25
256Kx16-70 VIDEO SOJ..(2CAS).....	\$18.00

CACHE SRAM

64Kx1-15ns 22-DIP.....	\$7.95
64Kx4-15ns 24-DIP.....	\$8.95
64Kx4-15ns 28-DIP (OE).....	\$9.25
8Kx8-15/20ns DIP.....	\$3.90/3.50
32Kx8-15/20ns 28-DIP.....	\$4.25/4.00
64Kx8-15ns 32-DIP.....	\$12.95
128Kx8-15/20ns 32-DIP.3mil.....	\$22.50/19.95
128Kx8-15/20ns 32-DIP.4mil.....	\$26/25

CPU & CO-PROCESSORS

386DX-33INTEL.....	\$29.00
486SX-25INTEL.....	\$25.00
486DX2-66 INTEL.....	\$75.00
486DX4-100 AMD/INTEL 3v.....	\$79.00/109
PENTIUM 60/90.....	\$150/219
80287-12.....	\$19.00
68040RC25.....	\$125.00
68882RC33.....	\$45.00

MISC.

PACKARD BELL UPGRADES.....	CALL
MOTHERBOARD BIOS UPGRADES.....	CALL
486 CPU 3V to 5V ADAPTER SOCKETS.....	\$41.00
EPROMPROGRAMMERS.....	\$129.95/139.95
16550 40-PIN UART.....	\$10.50
EPROMS & FLASH:	
27C256-150NS.....	\$3.95
27C512-150NS.....	\$4.50
27C010-150NS.....	\$5.45
27C020-150NS.....	\$7.95

* OTHER PARTS AVAILABLE, CALL FOR QUOTE * VOLUME DISCOUNTS OFFERED
 * PRICES SUBJECT TO CHANGE WITHOUT NOTICE * TERMS: COD (CASH), VISA/MC
 * MINIMUM ORDER \$20 FREIGHT: \$5 MIN.

LA PAZ ELECTRONICS INT'L
 P.O. BOX 261095, San Diego CA 92129
 TEL (800) 586-4199 FAX (619) 586-1482

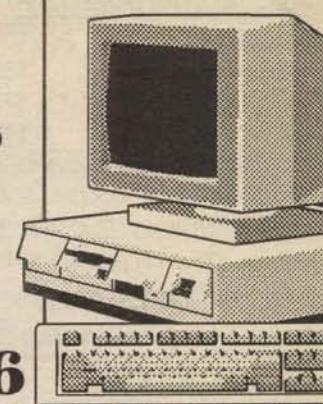
Write in 137 on Reader Service Card.

The 21st Anniversary of the World's Longest Running Personal Computer Show!

Trenton Computer Festival

at Mercer County Community College (NJ)
April 20-21, 1996

Saturday from 10am* to 6pm
 & Sunday from 10am* to 4pm



* Flea market opens 1 hour earlier

Over 125 Seminars

The computer industry's leading experts present programs on the latest business, technical and programming topics at all levels from beginner to advanced. Programs include the latest on the Information Super Highway/Internet, CD-ROM, CAD, E-Mail, Graphics, Programming, Desktop Publishing, Hardware, Word Processing, Networking, Business Applications, Operating Systems and much more! This educational opportunity is FREE with your admission!

Over 168 Indoor Booths

These commercial booths offer the best deals and bargains in brand new hardware, software and accessories. You'll find many prices that are below what you can get from these same vendors at their stores or through the mail.

Major National Exhibitors

Because they have often used TCF to announce the latest developments and releases you can expect to get some surprise announcements and the latest scoop from these national exhibitors. These indoor exhibits include industry giants like: Microsoft, Intel, Apple, IBM, Lexmark, Novell, Corel, PC Expo, O'Reilly and Associates, 7th Level, Adaptec, Ziff Davis and Internet providers: ESCAPE and Dorsai.

Special Support for Hearing Impaired

Special arrangements for the hearing impaired. If you need this service, contact TCF (see info below) or FAX 717-529-2785.

Largest Personal Computer Outdoor Exhibit Area!

You'll find acres of bargains in new and used computer hardware, software, accessories. 1000 outdoor vendor spots are available. Single spots are specially priced to make flea market spots affordable for anyone. Contact TCF (see below numbers and address) to reserve your space. Be quick, they go fast.

Saturday Evening Banquet

This sumptuous banquet is the highlight of the weekend. In the past featured speakers have included Bill Gates of Microsoft and Fred Gibbons of Software Publishing Corp.

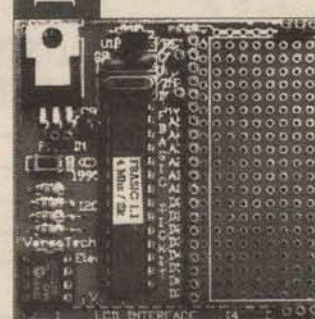
More Information via Internet!

You can get the latest information on TCF by requesting information via Internet E-mail. Just send an E-mail message to TCF.info@edit.com and you will get details about the festival, including updates as the festival draws near.

Admission

General admission is only \$8 for 2 days, \$5 Sunday-only. Students and Senior Citizens are only \$5 for 2 days. Children under 12 Free on Sunday-only (if with an adult). Preschoolers Free at all times. For more information or to reserve exhibit space, contact Jeanne/Glenn Eckman, TCF'95, PO Box 129, Kirkwood, PA 17536 or CALL: 717-529-6134.

FBASIC



VersaTech
Electronics

FBASIC TICKIT™
a PIC based, FBASIC language, microcontroller.

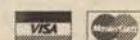
*It's your ticket to faster and easier prototype development.
 Great for data logging and robotics.*

MICRO-Controller

- 8K Eeprom
- 16 I/O Lines
- Signed 32bit Math
- 8bit RTCC Counter
- Interrupts
- RS232 Serial Routines
- Supports 4/8bit Buss
- Pulse Generation and Measurement
- Debugging
- PWM/Square Wave Output

To Order Call:
 (800) 940-5590 or (303) 440-5590

fax: (303) 440-9467
 bbs: (303) 440-7828



P.O. Box 18476
 Boulder CO, 80308

100% Satisfaction & Every day Low Price Leader

ALL Motherboards w/CPU:

386 SX40 MHZ	\$55
386 DX40 MHZ/128K	\$89
486 SLc33 MHZ	\$75
486 SLc 2-66 VLB	\$109

486 DX2 66 MHZ VLB 1w/256K	\$139
486 DX2-80 MHZ VLBw/256	\$149
486 DX4 100 MHZ VLBw/256	\$199
486 DX 120 MHZ VLBw/256K	\$219

586 DX 100 MHZ PCI 256K \$249

BUILT IN 4 EIDE, 2 FLOPPY AND FAST 16550 i/o

Floppy Drives:

1.44 MITSU	\$27
1.44 TEAC	\$30
1.2/1.44 COMBO	\$75

Member of
Better
Business
Bureau

Monitors:

14" MONO VGA	\$89
14" SVGA 39 DP 1024x768	\$195
14" .28 108 NH, Low-r	\$224
15" .28 1024x768 NH, Low-r	\$305

Keyboards:

101 KEYBOARD	\$15
KEYTRONIC	\$23

Focus 2000/2000+/8000 \$CALL

VGA Cards:

VGA 256K	\$27
TRIDENT SVGA 512K	\$38
TRIDENT 1MB	\$59
VESA VGA 1MB EXP 2MB	\$69
PCI / VESA VGA 2MB	\$119
SVGA CARDS WITH VRAM CALL	
ANY OTHER VGA CARDS PL CALL	

Controller Cards:

IDE CARD (2FD/2HD)	\$11
I/O (2S, 1P & 1G)	\$11
SUPER IDE-I/O (2S, 1P & 1G)	\$12
VESA EIDE-FAST I/O	\$19

Bisme Computer, Inc 1298 Reamwood Ave Sunnyvale, CA 94089 Tel: 408 745-7203

Write in 214 on Reader Service Card.

INTEL

PENTIUM 60Mhz
MotherBoard & CPU

\$219

Quad Sp Bundle

\$224

Quad Speed CD
16 Bit Sound Card
11 CD Titles
Amplified Speakers

Orders & PRICE

T * 800-899-6430

F * 800-745-1670

SERVICE

408 745-7206

Buy with
Confidence
Risk Free
30 days
Money Back

WE DO
CARRY
COMPLETE
SYSTEMS

Printer
Memory.

ONE YEAR
WARRANTY
ON PARTS
LIFE TIME
Labor
Warranty

Resellers
Dealers
Welcome

Terms:
No minimum Charge
No Hidden Charge
Prices change w/o Notice
15% Restock fee for Non Defective
Orders of \$350 or more
ground shipping free.

All Kinds Drives, Sound Cards

Speakers and CD Titles: Please Call

HARD DRIVES SPECIAL

214MB \$119	540MB \$169
850MB \$199	1.08GB \$225
1.2GB \$259	1.6GB \$299

Modem/Fax Modem:

14.4 PCMCIA	\$99
Fax/Mod. 14.4	\$45
Voice M /Fax /Mod 14.4	\$55
SUPRA F/Mod 28.8 Int	\$139
US ROBOTIC 28.8 Int	\$189

Cases with P.SUPLIES

MINI TOWER PREMIUM	\$40
DESK TOP CASE PREMIUM	\$45
MED TOWER CASE PREMIUM	\$62
FULL TOWER CASE PREMIUM	\$82

Credit Cards Ok

VISA MasterCard NOVUS Except Case, Monitor, Keyboard & F. Drives

"Triton" Intel Mother Boards with CPU

Pentium 100 Mhz w/CPU	\$479
Pentium 133 Mhz w/CPU	\$689
Pentium 150 Mhz w/CPU	\$769
Pentium 166 Mhz w/CPU	\$969

Please
Call for
any
other
Items

SCANNER MODIFICATION HANDBOOK. Big! 160 pages! More than 20 performance enhancements for PRO-2004 and PRO-2005. Restore cellular, increase scanning speed, add 6,400 memory channels, etc. Step by step instructions, photos, diagrams. Only \$18.95, +\$5 shipping (\$6 Canada). (NYS residents add \$1.98 tax.) CRB Research, Box 56, Commack, NY 11725. Visa/MC welcome. Tel. 516-543-9169.

MUSIC & ACCESSORIES

WANTED: VINTAGE audio components, tubes, catalogs, record cutting lathes. I MAKE RECORDS and CDs! 612-869-4963.

TURNTABLE, PHONO, record player parts. Stereo needles/stylus, magnetic, ceramic, crystal cartridges. All astatic metallic cartridges custom rebuilt \$19.75 postpaid. Obsolete idlers resurfaced \$8 postpaid. New 78 RPM turntable, semi-auto or manual, magnetic/ceramic output your choice only \$44.95 postpaid. Super Reference catalog \$2 or inquiries to West-Tech, PO Box 1415 Sebring, FL 33871. Phone 941-471-0922.

REBUILDING EARLY 70s era AMI-Rowe 45 jukebox. Looking for sources of parts, information, 45 records. Call or write: Al Wudel, 1209 N. 7th St., Estherville, IA 51334. PH. 712-362-4119.

ORIGINAL 1939 recording of ballad for Americans, by Paul Robeson. Two record set. Record #1 excellent. Very rare. \$100/OBO. For info write: Ballard, 7240 Newman Drive, Mt. Airy, MD 21771. A true collector's find.

COMPUTER HARDWARE

IDE 4A 16 bit \$15. AT IDE 2H/2F 16 bit \$9. TMC-8501BM SCSI option 8 bit \$15. Servo-Track 408-378-1374.

TANDY/RADIO SHACK Model 1/3/4, 1000 Support. Monthly magazine, software, parts, repair. Computer News, POB 50127, Casper, WY 82605-0127. 307-265-6483.

ZENITH COMPUTER parts, hard drives, disk drives, laptops, boards, keyboards, new and used computers. Please call Les or Mike at: Surplus Trading Corp., Benton Harbor, MI. 616-849-1800.

TRS-80 MODELS I, 2, III, IV, 12, 16, Pocket Computer, and COCO: Software, hardware, internal and external disk drives (360K/720K), hard drives (both complete and bubbles), replacement motherboards, floppy drive controllers, video boards, RS-232 boards, key-boards, and more. Send large SASE for list. Pete Bumgardner, Rt. 4 Box 36-H, Fort Payne, AL 35967-9408.

NEW MATH COPROCESSORS NEW and pulled Intel 80386DX or SX-16/25/33 \$16-\$30. Cyrix available also. Call Under The Wire Electronics, 818-930-1121 or fax 818-930-1123. 235 E. Colorado Blvd. #211, Pasadena, CA 91101.



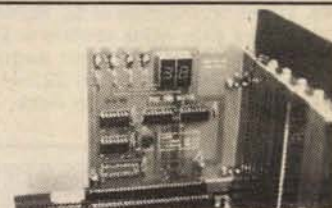
19" HEAVY DUTY Rackmount PC Chassis: 4U, 8-slots (expandable to 12 slots), one hidden 3.5"/one opened 3.5"/two opened 5.25" drive bays, front panel filtered fan, uses popular PS/2 style power supply (not included), \$229 (with this ad only)! Also available 8255-8253 digital I/O card at \$59, 12-bit AD/DA card at \$89, etc. We do business UPS Ground COD cashier's check only. **Computronics Technology, 214-242-8087.**

NETWORKING KIT all the hardware necessary to network your computers. Works with Windows for workgroups 3.11 and then popular. SW (2) systems \$49, (4) systems \$99. Dexis, 612-944-7670.

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

CANON BUBBLEJET, Apple Writer Ink Jet Refill Kit, highest quality complete with instruction and 10 refills, \$29.95. LOALCO, Box 7117, Delray Beach, FL 33482. 407-241-9990.

CRTs CHEAP. Buy direct from the manufacturer, save money. Mfg. all CRT types over 45 years. **3 Year Warranty.** 19 inch tubes \$60, 25 inch \$90. We specialize in **HI Resolution** computer/video CRTs and complete repair of all monitors. T.M.C. 215-226-0749/223-0388 9:00am-10:00pm EST.



BEEP BEEP? Repair IBM compatible PCs with the "POST CODE MASTER" plug-in card. Shows result of Power On Self Test performed by all major BIOSs. Manual reveals their meaning and also explains those cryptic beep codes, \$59. MSD, 4100 Moorpark Ave. #104, San Jose, CA 95117. 408-296-4000, Fax: 408-296-5877.

MACINTOSH/APPLE Repairs, Parts and Peripherals. Low prices on Macintosh, Apple II and peripheral repairs. Repairs of whole units or repair or exchange of parts. Sales of new third party peripherals. Used equipment available. Mac Shack 716-377-9230, FAX 716-377-9573.

CD-ROM DRIVES REALLY CHEAP! NEC 3X SCSI-2 CD-ROMs \$85 ea. Toshiba external 3301B SCSI-2 CD-ROM \$55. Ideal for the Macintosh or PC (PC interface for \$15). Other CD-ROMs available, too. (Open 9am-5pm PST.) Call UTWE, 818-930-1121 or fax 818-930-1123.

MONITOR AND CPU schematics for Hyundai, Packard Bell, Compaq, Apple, Aamazing, Adds, AT&T, IBM, DEC, CTX, Dell, Gateway, HP, Epson, Loop, Mitsubishi, NEC, Samsung, Tatung, Wyse, Zenith, and many more! \$39.95 and up. Call 513-335-4560. Or FAX us at 513-339-6344.

Starlite Electronics

Highest Quality Test Devices
Lowest Possible Prices

FULLY ILLUSTRATED
INSTRUCTION

FULL TECH
SUPPORT

ZENITH COMPATABLE ST MODELS ONLY

MODEL	1'S	10'S
Z-TAC ZF-1	\$15.95	11.95
NEW!		
Z-TAC III	\$19.95	15.95

PIONEER COMPATABLE

MODEL	1'S	10'S
51XX-61XX	\$35.95	25.95
63XX-67XX	\$35.95	26.96
ALL NEW!		
63XX WRITER	\$59.95	54.95

TOKE 28-PIN U.I.X ONLY

STOCK #	1'S	10'S
03 U.I.X	\$17.95	13.95
07 U.I.X	\$17.95	15.95

MISCELLANEOUS

MODEL	1'S	5+
FM-TRAP	\$19.95	CALL!
T-7 TORX	\$6.95	CALL!
T-15 TORX	\$8.95	CALL!
T-20 TORX	\$10.95	CALL!
#3 BIT FOR	\$19.95	CALL!

CALL FOR BULK
PRICES. 10+

** NOTE **

It is not the intent of STARLITE ELECTRONICS to defraud any pay TV operation and we will not assist any company or individual in doing the same.

STOCK #	1'S	10'S
XP/DXU/DXBB 5	\$24.95	15.95
XP/DXU/DXBB 7	\$29.95	19.95
MP-1 SD	\$34.95	29.95
NEW! FOR DXBB		
R/20/5 ect.	\$39.95	33.95

FSK DEVICES

PIONEER	\$125.00	5+ CALL!
*** ALL	\$125.00	5+ CALL!

SCIENTIFIC ATLANTA COMPATABLE

MODEL	1'S	10'S
8580 NEW		
VER 8 WIRE	\$39.95	29.95
8570/80/90	\$49.95	45.95
8600		
8500/50	\$28.95	20.95

Orders

718-843-7671

ALL TEST DEVICES COME
FULLY ASSEMBLED & WIRED

Fax

718-843-7627



NOVAPLEX

The One-Stop Source for Cable Parts, Tools & Accessories

Only Novaplex Brings You So Many Great Low-Cost Converters

Centurion

Introductory Offer! For a limited time only, 10-lot price is only:

only \$65

The New Centurion converter offers a number of powerful features:

- parental control
- switched AC outlet
- sleep timer
- remote control included
- auto/manual fine-tune
- favorite channel memory
- batteries included
- jumper cable included
- illustrated user manual
- LED display

place your orders soon—demand for the Centurion is high!



NOVAVISION

Watch one channel and record another any quantity **\$199**



MILLENNIUM

Configure the various option packages to suit your needs 10-lot: **\$62**



Panasonic TZPC 145 Converter SA 8511-300 Converter

Units sold with wireless remote control & batteries. Features include: parental control (Panasonic only), last channel recall, favorite channel memory, sleep timer, channel 2 or 3 available.

In quantities of 10 or more, **\$65**



Panasonic TZPC 145 \$65
channel 2 or 3; 10-lot prices

SA 8511 channel 3 8-lot: \$65

Also: Panasonic TZ-PC 175 Series Converter w/volume. Topcases for Panasonic, SA and Jerrold (all models) also available. Call for pricing and availability.



Quality SA-Compatible Remotes



SRC 8600A
Operates 8600 on-screen programming converters

\$6.25



SRC 475A (w/volume)
Operates 8540 & 8590 series volume-control converters

\$6.25



SRC 175A
Operates 8500-8590 series non-volume converters

\$5.75



SRC 075A
Operates all beige 8500 series converters

\$5.75

Also available: Tocom, Hamlin, Pioneer, and Panasonic compatibles; all prices quoted in this ad are:

10-lot prices

Full Line of Jerrold-Compatibles



PIRC 82A
Operates Pioneer 8200 series converters

\$6.25



JRC 450A
Operates Jerrold DRZ 450 series converters

\$5.75



JRC 550A (w/volume)
Operates DP, DPBB, DPV, DQN 587, Starcom VI, & DL4 series converters

\$5.75



ZRC 3 (Zenith)
Operates all Zenith PM, PZ, ST series

\$6.00

Dozens of other items in stock!

Jerrold- & SA-compatible topcases with lenses
Torx Bits & Drivers (all brands)
Capacitors (every voltage) at 1000-lot prices

from \$3.25
from 3.95
from .06

Call for quantity discounts!

Kester Solder 44 Coresize
Jumper cables (1, 3 & 6 ft.)
Jerrold- & SA-compatible bezels & lenses

from \$8.45/roll
from .60
from .95

Call for your free catalog!

NO DESCRAMBLER SALES!



Call Toll-Free 8am-6pm PST 800-644-6682

Novaplex, Inc. 8818 Bradley Ave, Sun Valley CA 91352
FAX: 818/504-6522 COD, MasterCard, Visa, Credit Terms

Panasonic™, Jerrold™, Zenith™, Tocom™, Pioneer™ and Scientific Atlanta™ are trademarks of their respective corporations and are not affiliated with Novaplex, Inc.

Like many readers, I have coveted a satellite dish for years. Unlimited channels, low or no cable-like fees, exotic TV from foreign lands, and sports. Unfortunately, my budget and neighborhood prohibited my dreams. Instead, I shelled out huge fees for cable television and its limited fare. That all changed with the introduction of Digital Satellite Service.

Digital Satellite Service is really a cross between conventional satellite service and cable TV. Two hardware components make up the physical portion of the DSS system. The most unique element, and also its most appealing feature, is the 18" satellite dish which can be easily mounted to a house, apartment roof, or fence. The only limitation is that the dish must face a clear line of sight to the southwest.

Unlike a conventional antenna, the angle of signal is very narrow, so even the smallest obstruction will prevent any signal at all from being received. The dish mounts virtually anywhere on a house, and can also be chimney or pole mounted.

Note that, if you want to install the system yourself, you may not be able to tap into your existing cable wiring. Cable TV uses a cheap, low-impedance coaxial wire, which can't handle the signal needs of the satellite. Instead, you should use high-impedance coaxial cable, like the kind that comes with the installation kit, which, while physically identical, handles the higher signal load of the dish. I have successfully used my internal house cable wiring to split the satellite signal to a second television.

Two dishes are currently available: a single polarity model that is sold with the basic unit; and a dual polarity which comes with the deluxe multi-television unit. Unlike cable television which sends all of the necessary signals waiting for your television or cable box tuner to select a channel, the satellite dish box directs the dish to receive a specific channel. This type of sys-

tem is the biggest drawback to a DSS system.

If you only want to watch satellite transmissions on one television, or don't mind watching the same thing on all TVs in your house via a splitter, a single polarity system can be purchased at a cost of less than \$500.00. However, if others in your home don't share your interest in watching Batman the 37th time or every NBA basketball game, you will have to invest approximately \$1,400.00 for both the deluxe system with dual polarity signal and another television set controller box.

Beyond two televisions with separate signals currently requires another dish, but third party plans may result in a device which allows additional televisions to receive unique programming, with the purchase of an additional encoder box. RCA also sells an additional television signal kit for \$99.00, which includes 100 feet of cable, a gold plated splitter, a DSS remote control, and an infrared transmitter and receiver which allows channel changing on the transmitting box of up to 150 feet. This system upgrade still limits the programming that can be watched to the same channel on the transmitting system as the receiving system.

The satellite control box is far more complex than the average cable box. About the size of a small VCR, it offers some face controls for channel switching between the satellite signal and your local antennae. The back offers outputs for both RCA and SVHS, as well as stereo sound. There are also unused serial port connectors labeled low band and high band

Digital Satellite Service

by Michael Posner

which may, someday, provide high-speed Internet access. There is also an RJ11 phone connector. You must keep the box connected to the phone line at all times in order to use the special ordering features of the system. The set top box also utilizes a small credit card-sized security card which contains account information about your system. The card must be kept in the machine at all times.

Programming is provided by two separate companies: DirectTV and USSB. The system currently has over 175 channels which are available for a fee in several packages. Unlike regular satellite programming, there are no discounts for programming. Expect to pay the same or more per month than your existing cable bill. What you do get for your money is more of everything.

Each month, there are 50 to 60 pay-per-view movies available at a cost of \$2.99. These generally become available at the same time as the movie in the video store. The non-premium channels include both the common channels, including three ESPNs, two Disney channels, CNN and CNN International, and about 40 more channels (see sidebar). Movie lovers are well served with 15 premium channels from HBO, Showtime, Cinemax, Starz, TMC, and Flix. There are also commercial free older films presented on Encore's theme channels: Love, Mystery, Western, and True Life.

Special-order channels include the direct sports line which provides all of the NFL, NBA, NHL, or MLB games. Additional regional sports

channels and college football packages are also available. Playboy Channel is available on a daily or monthly basis as is a separate "adult" channel. For those with a taste for the exotic, Asia TV is also available, but it mostly plays bad Indian movies.

Music lovers will also appreciate the DSS system. Currently there are 25 commercial free, CD audio quality music channels covering all music genres.

One drawback to the satellite system is the lack of support for local channels. Most users either keep their lifeline cable programming (the local channels for about \$7.00 per month) or use a separate television antennae. DSS does offer one feed each of CBS, NBC, Fox, and ABC if you haven't had cable TV in the last 90 days. This gets you national programming at a loss of local news and information for a small monthly charge.

The DSS system is easy to use once installed. An on-screen program guide controlled by the remote shows a listing of all available programs, as well as the ability to narrow your viewing list by subject, such as movies, sports, or others, so, for example, you could find all of the comedy movies on in the next 60 hours.

Overall, I am quite pleased with my DSS system. For the same monthly fee as my old cable bill, I get 100 more channels, higher-resolution viewing, easier channel surfing, and lots of movies and sports, including every Philadelphia Eagles football game.

Next time, I'll discuss the technical aspects of the DSS system. **NV**

PROGRAMMING OPTIONS

A&E
American Movie Classics
American Talk
Bravo
Black Ent. TV
Bloomberg Television
Bravo
Cartoon Network
Cinemax
Cinemax 2
Cinemax West
CNBC
CNN International
Comedy Channel
Country Music Television
CourtTV

CSP1
CSP2
Discovery Channel
Disney East
Disney West
E!
Encore: Action
Encore: Drama
Encore: Love Stories
Encore: Mystery
Encore: WAM!
Encore: Westerns
Encore: 60s, 70s, and 80s
Encore: True Stories
ESPN
ESPN2
Family Channel
Flix

Golf Channel
HBO
HBO2
HBO3
HBO West
HBO 2 West
Headline News
History Channel
Home Shopping Network
Home & Garden TV
Lifetime
MTV
Mucho
Music Choice (28 channels)
Newsworld International
Nickelodeon
Regional Sports Channel
Sci-Fi Channel

Showtime
Showtime 2
Showtime West
Starz West
Starz East
The Learning Channel
The Movie Channel
The Movie Channel West
The Weather Channel
TBS
TNN
TNT
Travel Channel
TRIO
Turner Classic Movies
TV Asia
USA
VH1

RF POWER TRANSISTORS • TUBES • POWER MODULES

EIMAC • SVETLANA • AMPEREX

Best pricing on US & Russian

Transmitting Tubes

Receiving Tubes

3-500Z 3CX400A7
3-500ZG 3CX400U7
4-400C 3CX800A7
572B 3CX1200A7
811A 3CX1200Z7
6146B 3CX1500A7
6146W 3CX3000A7
8072 4CX250B
8560AS 4CX400A
8873 3CX800A
8874 6LF6
8875 M2057

Etc!



• MOTOROLA • MITSUBISHI

• TOSHIBA

Complete inventory for servicing amateur and commercial communications equipment.

MRF454 SAV6
MRF455 SAV7
2SC2290 SAV17
2SC2879 M57737

Etc!

Send for your
FREE
1996 Catalog

Same Day Shipping

Tel: (619) 744-0700

Fax: (619) 744-1943

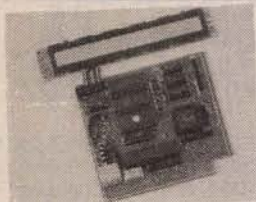


Write in 136 on Reader Service Card.

COMPUTER HARDWARE cont.

ZENITH COMPUTER PARTS SuperPort 286/386 keyboards, new, \$25 each. Power supplies \$30 each. Many other parts for Zenith computers. Call Surplus Trading Corp., 616-849-1800. We ship UPS COD.

www.usedcomputer.com - The Used Computer Mall™ at <http://www.usedcomputer.com> on the world wide web lists nearly 1000 dealers who buy, sell, and trade used computer equipment, and supply parts and service, too. They are well indexed by brand and type of equipment, so that you can quickly find the dealers you need. Visit the mall today to fill all of your used computer equipment needs.



LOW COST MICROCONTROLLER DEVELOPMENT SYSTEMS: 80C552 (8051 core processor) 8 channel 10-bit A/D, PWM, RS-232 port, 32K ROM, 64K RAM, 24 more I/O, \$120 each. 80C31 32K ROM, 32K RAM, 24 more I/O, RS-232 port, \$70 each. 68HC11 8 channel 8-bit A/D, RS-232 port, 32K ROM, 32K RAM, 24 more I/O, \$120 each. Complete development system includes SBC, assembler, disassembler, real-time execution and debugging, monitor and example programs (\$70 more). 40x2 LCD display \$20. Universal Microprocessor Simulator/Debugger V2.1 \$100 each CPU. 27C256 EPROM \$15 for ten. J&M Microtek, Inc., 83 Seaman Road, West Orange, NJ 07052, Tel: 201-325-1892.

IBM KEYBOARD Emulator: Tiny module allows PCs to start-up with no keyboard attached. Technician's pocket tool, commercial applications, or any dedicated IBM computer. \$39 @ Two-Bit Score, 4418 Pack Saddle Pass, Austin, TX 78745. 512-447-8888. TWOBIT@IO.COM <http://www.io.com/~twobit>

6 FT. surge suppressor, new \$5. Serial mouse, new \$8. 3.5 floppy disk mounting kit, new \$3. Servo-Track 408-378-1374.

QUALITY NAME brand computer products, excellent prices; AST, Digital, Hewlett Packard, MicroSoft, 32,000 products, new and used desktop and notebook computers; custom configurations; major credit cards accepted. Call/FAX for complete catalog on disk. Applied Computer Technologies, 703-771-8152. FAX 703-771-8588.

ORIGINAL IBM PC model 5150, the computer that started the revolution in original IBM packaging. Dual floppy, 256K RAM, mono monitor, keyboard. All like new. Complete system for only \$100. Call RTEST 419-697-1133 10am to 6pm. 166 Oak, Toledo, OH.

OBSOLETE ICs, SLOW OR BAD SIMMS. We buy mother bds. All types of memory bds. EVEN SOLDERED IN CHIPS. We buy it all. Call John at L&M Technical Recycling. 1-800-514-3447.

BUYING & Selling IBM computer parts. Repairing most IBM compatibles, C-64, Timex, and other classic machines. SASE for info. Computer Classics, RT-1, Box 117, Cabool, MO 65689. 417-469-4571. FAX 417-467-4571.

PCs CUSTOM designed and built, special features incorporated to your requirements. We can build them small, wall mount, anti-vibration, sealed, super cooled, or whatever your needs. Quantities as low as 10. Fax requirements to Fujimi Ltd., Hong Kong, +852-2834-0463.

SONY MULTISCANS 0.26DP 15.7 thru 36KHz CGA thru SVGA (1024 x 768 I). Great for Omegas \$175. Generic SVGA color monitors from \$125. Expert Sony repair, parts available. Dealer discounts. Refurbished guaranteed. Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

CD-ROM DRIVE S/SP used \$10. CD Myst Windows OEM \$8. CD Compton's Encyclopedia '94 \$6. Memory call. Servo-Track 408-378-1374.

NEW HARD and floppy disk drives 360K floppy drives \$8 each, \$50/10. 1.2 meg drives also available. New Toshiba MK234FB 106 meg SCSI \$59. Other drives available large and small. Call UTWE 818-930-1121 or fax 818-930-1123 (open 9am-5pm PST).

TCJ The Computer Journal

THE COMPUTER JOURNAL magazine has articles on 8-bit computers, new and old, and articles about ASM, Forth, and "C." Features centerfolds of older computer cards and circuits. \$24 per year (6 issues). PO Box 3900, Citrus Heights, CA 95611-3900. Credit card orders can call 1-800-424-8825 or 916-722-4970.

INVERTALT PAT. pend. plug-in cigarette lighter of vehicle. Produce 115V-60Hz 3000W max. Operate tools, appliances, electronics, etc. anywhere. Use only 0.2A on battery. Weight 7 lb. Model 12V-1200W \$399. S.A.C., 5403 VAN HORNE, MONTREAL, QUEBEC, CANADA H3X 1G2. PHONE 514-739-2524, FAX 514-343-9599.

WANTED: TRACKSTAR card, manual, and software. Card originally made by Diamond Computer. C. Ellis, 1129 East Mission, Phoenix, AZ 85020.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Now selling memory. We can beat any printed price in Nuts & Volts. Call 1-800-4-MEMORY now! Voice/FAX.

IC MASTER

The Most Complete Reference Available

The Famous Hearst Publication

Blowout



LIQUIDATING WAY Below Distributor Cost

The 3 Volume ICM is the Most Comprehensive IC Reference Ever Published. 100,000 IC's of EVERY KIND from Every Manufacturer. Specifications, Datasheets, Crossreferences, Alternate Sources, Manufacturer Profiles & Distributors. The 4 Volume EEM is the largest Component Parts Directory available. All the Major Parts Manufacturers display Entire Product Lines with Pictures & Data Sheets. Cabinets, Transformers, Pots, Semi's, Resistors, Capacitors, Crystals, Coils, Connectors, Wire, Heat sinks, Switches, Fuses, Speakers, Displays, an Endless list! This Extraordinary Library is perfect for Service, Designers, Distributors & Experimenters. The Complete SEVEN Volume Set Weighs in at 27 Pounds! Finallyit's AFFORDABLE! (EEM is available for \$25 ONLY to those who purchase the ICM)

Netcom 800-881-6247 ext 6300 516-826-1808 x 6300 9am-11pm EST 7Days

Write in 175 on Reader Service Card.

American Trap Company

Orders and Information

1-800-684-0527

We carry a full line of negative traps

EVERY CABLE CHANNEL AVAILABLE

EASY, SIMPLE INSTALLATION. NOTHING MORE TO BUY

Block any unwanted Cable TV Channel

- ☐ Block Cable Channels and insert Video Games, Satellite or DBS Systems.
- ☐ Block Sexually Explicit Cable TV Channels.
- ☐ Block Channels only to specific TV's in your Household.
- ☐ Block Music Channels, (R) Rated Premium and PPV Events.
- ☐ Security Better than Parental Control.

REMOVES VIDEO AS WELL AS AUDIO

\$16.00 ea Ch# 2-62 \$19.00 ea Ch# 63-78

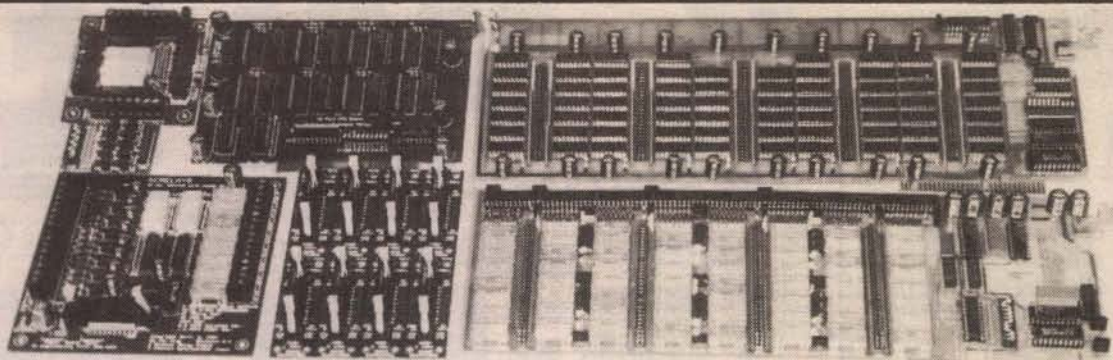
Quantity Discounts Available on 5 or more

Distributors and Dealers wanted for all areas. Large profit potential. CALL TODAY

Check us out on the INTERNET

WEBSITE: <http://www.gocable.com>



**SCPIO16****128 Channel I/O Board**

- FREE I/O Tester board when you buy SCPIO16
- Directly drive many popular Solid State Relays.
- Interface to TTL, LS, HCT, ALS, AS, FCT, etc...
- Blows away performance of 8255 I/O boards.
- Outputs source & sink more current than 8255s.
- Powerful yet very inexpensive. With software.
- 16 Byte wide ports. 8 In + 8 Out. 1/2 card size.
- Sustained I/O > 500 K Bytes / Second.
- High noise immunity low load CMOS inputs.
- With power, ground, read & write strobes.
- Cards can share same space via extended I/O.
- Machine pin sockets make field repairs a snap.
- Silk screened, solder masked, & gold plated.
- See SCREWTERM, TERMACK, SCRELAY8

SCREWTERM**16 Channel Screw Terminal Board**

- Directly interfaces to any port on SCPIO16.
- Supports 8 Input + 8 Output channels.
- LED Bargraph Displays monitor inputs & outputs.
- Screw terminals for all I/O, control & power lines.
- Termination resistors increase noise immunity.
- Fuse protected power lines.
- Screw terminal blocks socketed for quick release.
- Minimize your setup time.
- Reduce maintenance and repair costs.
- Saves many hours of building & wire wrapping.
- Shrouded Gold plated header with ejectors.
- Boards are Solder Masked & Silk Screened.
- I/O, Pwr, Gnd, Cntrl identified with legends.
- 3"x3" board with mounting holes & hardware.

TERMACK**128 Channel Termination Board**

- Directly interfaces to SCPIO16
- Supports full set of 8 SCPIO16 cables.
- Supports 128 channels. 64 Input / 64 Output.
- 2 solder pads for ea. signal, control, & power line
- Provides simple interface to Solid State Relays.
- Easy interface to many other devices.
- Simple interface to wide range of sensors.
- Saves many hours of building & wire wrapping.
- Shrouded Gold plated headers with ejectors.
- Boards are Solder Masked & Silk Screened.
- I/O, Pwr, Gnd, Cntrl identified with legends.
- Large solder pads with plated through holes.
- Wide dual signal traces increase reliability.
- Plenty of well spaced mounting holes.

SCRELAY64**64 Channel Relay Board**

- 64 SPST 10VA 100 VDC 70 VAC 0.5 AMP relays.
- Use to drive solenoids, valves, relays, contactors.
- 16 Relays per 64 line gold plated header.
- 2 pins per relay line reduces resistance
- Independent A & B lines on all relays
- High density board reduces computer slots used.
- Sensitive relays minimize power consumption.
- Only 1.0 milliseconds to turn on/off relays.
- Long life relays (10,000,000 operations).
- Cards can share same space via extended I/O.
- Power on reset leaves relays open on power up.
- Uses 16 Byte wide ports. 8 Input + 8 Output.
- Full length PC AT form factor card for 8 bit slot.
- Input ports can read back state of any relay.
- Gold plated 64 line headers support 16 relays ea.
- Silk screened, solder masked, & gold plated.
- Includes manual and software.

SCPROBE**240 Channel Stimulus/Response**

- Ideal to test cables, wire harnesses, PCBs
- Use for ATE, testing switch matrices & boxes.
- 240 Output paired with 240 Input channels.
- Use to stimulate any line
- Then monitoring all other lines for responses.
- Set port 0 to stimulate any 1 of 240 channels
- Set port 1 to monitor selected channel.
- Read port 0 to determine response.
- Then scan 1 to 240 channels for response.
- Multiple boards may be used in system.
- Open collector outputs with 5.1K pullups.
- Every output paired with an input channel
- Uses only 4 ports in PC I/O space.
- Full size fuse protected PC/AT form factor card.
- Gold plated 50 line headers. 48 signal+pwr/gnd.
- Machine pin sockets make field repairs a snap.
- Silk screened, solder masked, & gold plated.

SCRELAY8**8 Optoisolators + 8 Relays**

- Drive solenoids, valves, relays, & contactors.
- Monitor external events & power sources.
- Directly interface to any port on SCPIO16 board.
- 1500 V optically isolated inputs.
- SPST 10VA 100VDC 70VAC 0.5Amp relays.
- Sensitive relays minimize power consumption.
- LED Bargraphs display input & output status.
- Opto inputs monitor AC/DC 0..32 volt lines.
- Independent A & B lines on all relays
- Power on reset leaves relays open on power up.
- Fuse protected power lines.
- Supports use of optional external power supply.
- I/O, Pwr, Gnd, Cntrl identified with legends.
- 5"x5" board with mounting holes & hardware.

MIDI**SCMIDI16****MIDI****128 Line MIDI Digital I/O Board**

- Control real world devices from MIDI systems.
- Turn 64 digital devices on/off as music plays.
- Accept commands from up to 64 digital inputs.
- FREE I/O Tester board when you buy SCMIDI16
- Accepts MIDI commands from MIDI controllers
- Programable MIDI Channel number 1..16
- On board computer converts notes to Outputs
- On board computer converts inputs to Notes
- MIDI IN/OUT/THRU on 5 pin DIN connectors.
- Will drive any SCPIO16 accessory
- Uses same cables as SCPIO16
- Drives SCREWTERM, TERMACK, SCRELAY8
- Will drive upcoming light dimmer board.

SC Engineering 1961 E. Whittier Blvd La Habra, CA 90631-4131 (714) 870-4237 (Voice & FAX!)

Write In 58 on Reader Service Card.

"QUICK BOARDS" FOR ALL MODELS

S.A. 8500s\$23	S.A. 8580s\$23
S.A. 8550\$23	S.A. 8590s\$23
S.A. 8570\$23	S.A. 8600-H\$23

ZENITH, STEALTH DECODER AND MUCH MORE.

CALL US FOR ANY ADDITIONAL PARTS NOT LISTED:

1-800-667-8361

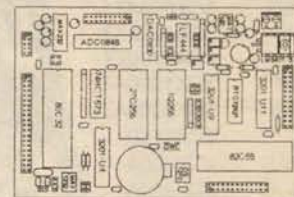
ALL PRICES BASED ON 10 PC. QTY.

I.S., INC.

OPEN MON.-SAT. 9:30 AM - 5:30 PM

CATALOG. PARTS: RF, analog, digital, audio. Two stamps. Johnson Shop Products, Box 2843, Cupertino, CA 95015.

NEED MONITOR SCHEMATICS? 200+ FCC ID codes cross referenced to monitor manufacturer name and phone number. Also, parts suppliers phone numbers. Paper copy or 3-1/2" disk for Windows. Send \$15 to: Computer Vision, 6905 Indian Bay Rd., Montague, MI 49437.



VERSATILE 68HC11/80C32 single board computer 32K RAM and 32K EPROM. Extended basic, 8 channel A/D, D/A, real time clock, parallel printer port 24 bits of I/O. Power supply, terminal emulator software and utility disk included. \$140 kit or assembled and tested. \$5 S&H, add \$5 for COD. DC Micros, 1843 Sumner Ct., Las Cruces, NM 88001. 505-524-4029.

MONITORS 19" RGB 1280 x 1024. DEC, Hitachi & HP. \$175-\$275. Delivered in continental US. **SUN WORKSTATIONS:** Model 3/60, OK, keyboard, mouse, 19" RGB \$320. **SPARCSTATION 1** keyboard, mouse, Ext. tape \$250. 4/60 CPU \$150. Silicon Resources, 914-339-8802.

DEALERS, TECHNICIANS: Do you throw away bad power computer switching power supplies? I can show you how to fix 9 out of 10 in less than a half for under \$10. I'm selling a schematic, extensive theory of operation, and a complete troubleshooting guide. The price? \$40, the cost of one supply. It will pay for itself with the first repair. Jim, 520-623-8994. PO Box 5123, Tucson, AZ 85703.

SPECTRE

COMPUTER HACKERS BLACK BOOK: Monumental instructional manual reveals everything from A to Z on hacking! Covers: Unix hacking, pads & NUIs, brute force hacking, packet networks, outdials, university computers, NUAs, Tymnet, Datapac, SprintNet, LANs, password cracking, Primos, DECS, TOPs 10/20, wide area nets, government computers, HP mainframes, telenet, credit bureaus, RSTS, capturing accounts, Iris & NOS, backdoors, remote access, Novell, software cracking, PICK, fraud, Rampart, Xenix, banking systems, databases, Vax/VMS hacking, user names, Arpanet, Amos, Cyber systems, spoofing, fake E-Mail, Cosmos, The Well, hacking AOL, Milnet, Gateways, CompuServe, Bitnet, BBS, Trojan horses, Linux, Prodigy, VMCS & XMUS, password shadowing, NIS, Autonet, Stair Stepping, AOS/VS, trapdoors, AS400 & TSO, Genie, and much more! **The largest and most indepth publication ever!** For reference use only. Software manual \$22. **SPECTRE PRESS**, PO Box 5112, N. Muskegon, MI 49445.

PIONEER 6300 cable boxes w/remote and no E-4 modules, map switch, pretested in raw test mode, 1 yr. warranty, special \$195. P10 no E-4 PIC modules 5+ \$16 ea. P10 6300 master files with serial # conversion Win 95 ver. \$250. PIC 16C54 no E-4 program with serial # \$200. P10Writer \$75. 7 days 7am-9pm PST. 702-892-9183.

PLOTTER HP 7475A 6 pen \$95, HP 7550A 8 pen \$125, HP 7470 2 pen \$75. All units tested and come with cables. Call John 7-9:30 EST MD 301-934-4912.

PLOTTERS: HP 7580B drafting plotter (sizes A-D) \$1,375. **HP 7475A** \$230. **HP 7550A** \$395. Excellent condition, warranty. Pepper Systems, 214-353-0257.

250 MEG. Hard Drives only \$45 plus P&H. 1/2HT., SCSI, Heavy duty design, Mint condition. Order while supplies last. Call: 708-344-5096 now!

SIMM 1, 2, 4, 8, 16, 32 meg: All are brand new. 1 meg 30 pin 70ns/60ns \$29/\$31, 4 meg 30 pin 70ns/60ns \$105/\$116, 4 meg 72 pin 70ns/60ns \$103/\$113, 8 meg 72 pin 70ns/60ns \$215/\$230, 16 meg 72 pin 70ns/60ns \$425/\$445, 32 meg 72 pin 70ns/60ns \$825/\$875. All SIMM modules available. 1 yr. warranty. Call Yub Sung, 603-893-5866, Salem NH for current price/availability.

NEW COMPUTER POWER SUPPLIES. New full tower supply 230 watt \$30. Cube AT power supplies with switch on the side 235 watt \$28. Supply for full size AT case 230 watt \$25. NEW XT power supplies 150/135 watt new! \$18/\$12 ea. Call (open 9am-5pm PST) UTWE 818-930-1121. Fax your supply needs to 818-930-1123.

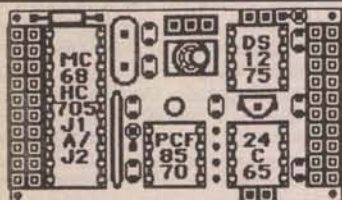
TOWER CASES! Black mini-tower with 145 or 200 watt supplies \$25/\$33 new mid-tower with 3 5-1/4 bays, 2 3-1/2 inch bays digital display 200 watt \$40, \$375/10. Call (open 9am-5pm PST) Under The Wire Electronics, 818-930-1121 or fax 818-930-1123. Quantity shipping discounts available!

486 DX4/100 computer systems, 4 meg RAM, 210 megabyte HDrive \$450. 486DX 2/80 \$425. SVGA monitors \$165. Call for other configurations. 635 meg HDrive \$165. 4 meg memory \$110. 14.400 FAX \$45. Word processor \$150. CCI, 714-778-0450.

EXTERNAL SCSI CASES WITH POWER SUPPLY for CD-ROM, tape drive, etc. Open faceplate for 5.25 drive. Used but in great condition. SCSI ID select and 50 pin Centronics connectors on the back. Only \$35 plus shipping. Call UTWE 818-930-1121 or fax 818-930-1123. 9am-5pm PST.

AMIGA MODEL A1011 3-1/2 inch external disk drives. Unit enclosed, with cable for hook-up. Brand new, boxed \$30 each. Shipping and handling included. Harold Pegler, 129 Ketchams Road, Syosset, NY 11791. 516-433-7753.

COMMODORE 64 with color monitor disk drive, manuals, demo disk \$155, printer add \$35 more hardware software SASE want Plus-4 Sperry 620C oscilloscope dual trace component checker 20MHz new no carton \$395. Ron Bauman, 711 Faulkner, New Smyrna, FL 32168.



KART COMPUTERS introduces **SPOT**, a new microcomputer with a unique operating/development environment. **SPOT** is a small (1.2" x 2.0" PCB) low cost microcomputer based on Motorola's MC68HC705J1A running at 4.0MHz. **SPOTCODE** is a unique new operating system designed for the 68HC05 microcontroller family. **SPOTCODE** is a development system. It allows you to download 68HC05 program code from your host computer into SPOT's memory. Once downloaded, this code can be run autonomously upon a power on reset. You can develop, test, debug, and run 68HC05 program code without ever programming (burning!) a single MC68HC705J1A. No expensive programming package is required! **SPOTCODE** creates a **VIRTUAL 68HC05**. It allows large sophisticated programs to be run from serial EEPROM. Program memory is 8K EEPROM (expandable to 64K). Variable memory is 256 bytes RAM (expandable to 2K). In effect, **SPOTCODE** turns SPOT into a **VIRTUAL 68HC05 64K Monster**. The **Mezzanine J-Bus Peripheral interface** allows for stacking multiple boards. The RS-232 interface supports eight BAUD rates including the 31250 MIDI rate. There is an 12C BUS interface and 12 programmable I/O lines. **SPOT** sells for \$49 and comes with hardware/software documentation. **SPOTCODE** Licenses are available. **KART COMPUTERS**, PO Box 144, Millbury, MA 01527. (508) 755-9778.

MOTOROLA EVM. New, MC68HC05, \$350. Also MC68705, used, \$250. Both orig. \$500. 614-870-7440. Free pagers available now! Just call 1-800-724-3637. Special offer certificate #20934901. Note: Activation required at time of redemption.

ZENITH LAPTOP 80C88 no HD \$125. **NEC** laptop 80286 20MG HD 1MG RAM \$300. **NEC** laptop 80386 40MG HD 2MG RAM \$500. **IBM PS2 80286** 1MG RAM 30MG HD VGA monitor \$250. **ZIGLOG** mainframe/50 monitors \$1,000. Each computer has modem and software. Call **NAC**, Jack Jones, 918-342-4648.

HARD-TO-FIND APPLE2 hardware, accessories, software, documentation and games. Apple graphics tablet with Polarware's complete graphics system, \$125. Mach3 joystick, \$35. Prodev2gs software developer (NMI) card, \$100. CallBox software, \$60. A/E sonic blaster, \$69, and more. Send SASE for complete list to: **JMP Associates**, Dept. 142, 6052 Wilmington Pk., Dayton, OH 45459-7006.

BRAND NEW new with warranty! Motherboards **PENTIUM 75/90/100 W/CPU**, 256K Cache, EIDE. Fastest 486DX4/100-120 MHz DX2/80 \$99 multimedia Kits FAX/modems 14,400 BPS \$45. Monitors, **LAZER PRINTERS**, software, hard drives IDE, SCSI 65Meg-1.7Gig. \$55-750. Notebook hard drives 120-1300 MEG available. Complete desktop and notebooks available. DOS & WINDOWS package \$65. Call for monthly specials and items not listed. CCI 714-778-0450.

CABLE TV DESCRAMBLERS NOBODY BEATS OUR PRICE!

**SAVE MONEY-DON'T RENT
REPLACEMENTS FOR ALL
MAJOR MAKES AND MODELS**

QUANTITY DISCOUNTS! 24 HOUR SHIPPING

CALL VIDEO CONNECTION, INC.

1-800-677-0321

Anyone implying theft of service will be denied assistance.
NO FLORIDA SALES

Write in 174 on Reader Service Card.

Real CNC!



Get a Pro Control!

You've got hold of motors & drivers, but now what? Spend 3 years writing code? No way! Get our pro CNC software & cut real parts today! Fast & powerful, only \$549 -1,495 incl. ISA card. Or get full system, software-to-shafts: \$2K - 6K. CNC on a VISA! Since 1991.



ah-ha!
Design Group, Inc.

470 Cleveland, St. Paul, MN 55104, 800-473-7650 10-6 cst

Use Ah-ha! CNC...

for mills, lathes, PCB drills, wood routers, flame cutters, foam cutters, etc., etc....

- Very accurate & many, many features
- Toolpath Graphics, Help, PLC I/O tool
- Fanuc compatible G-code and HPGL
- Call NOW for a free catalog and a \$5 working demo. (\$15 w/manual)

We answer your questions.

Call 612-641-1797

Write in 135 on Reader Service Card.

HEATHKIT/ZENITH H-89/90 computers, 1 working, 1 bad P/S. 8" single and quad density, 5-1/4" single and quad density floppies. CP/M and HDOS, all manuals, software and documentation, lots of extras. Best offer, you pay shipping. 414-725-8630 or FAX 414-725-8621.

CHEAP AND simple network in a box! Kit includes everything you need for a three computer network in one box. Software, cards, manuals and cables. Expandable! up to 800 feet between systems! Share printers and disk drives! 1MBS transfer speed! Brand new sealed kits from Western Digital. Only \$45 each kit! Under The Wire Electronics 818-930-1121 or fax 818-930-1123 (open 9am-5pm PST) E-Mail: UTWESALE@aol.com

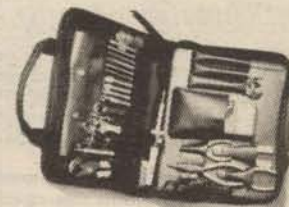
STUPID CHEAP MEMORY FOR YOUR SYSTEM FOR AS LITTLE AS \$20/MEG! Using our 3 meg RAM card (\$15) and socketed memory for \$15/meg, you can add 3 meg of RAM to your system for \$60. 286, 386, 486, 586 required. Multiple cards in one system okay! Supports extended, expanded or XMS standards. Call UTWE 818-930-1121 for details.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 513-847-2300 OR fax 513-847-2350.

FOR THE BEST PRICES ON PROFESSIONAL TOOLS, CALL ELECTRO-TOOL



platt - Case - Deluxe Polypropylene. Chemical Resistant. Tools by CooperTools and others. 800T Case, complete with tools... \$389.99
800T Case Only... \$114.80

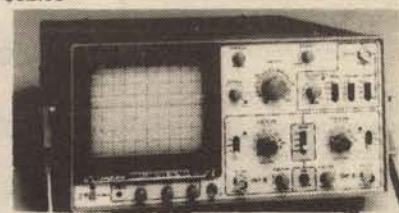


platt - Case - Cordura Exterior. Two exterior pockets & one literature pocket. 660ZT Case, complete with tools... \$208.00
660ZT Case Only... \$57.40
Optional Sperry meter #DM6510 as shown... \$63.95



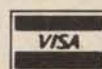
Weller WCC100 - Electronically controlled station, temperature adjustable from 350°F-850°F. Zero voltage circuit-safe for sensitive components, 40 Watt pencil... \$92.00

OptiVISOR - Superior magnification, Optical Glass Prismatic lenses, (not plastic) Select any one of (6) magnifications... \$22.50



GoldStar - 20 MHz Dual Trace Oscilloscope OS-9020A-Large 6" rectangular, high sensitivity: 1mV/div, high accuracy: ±3%, stable, low-drift design, 8 divisions of displayed dynamic range and accurate, distortion-free waveform measurements... \$370.80

Electro Tool, Inc.



9103 Gillman, Livonia, MI 48150
Customer Service: (313) 422-1221
ORDERS ONLY: 1 (800) 772-3455



"Tools American Made."

Write in 213 on Reader Service Card.

CANON BJC-610 \$530 5xCD-ROM only \$140, 4xCD \$120, 4 meg 72 pin \$30 486 upgradeable motherboards \$85, CPUs 66/\$38, 80/\$45, 100/\$95, 120/\$110, Pentii Triton motherboards \$150, CPUs 75/\$170, 90/\$250, 100/\$298, 133/\$525, 1.2 gig Conner HD \$265 keyboards, Enhanced 101/\$17, mouse \$8, Labtek 150 speakers \$12, modem internal 28.8/\$115. Call 717-275-0666 or WWW.RJELC.COM Orders 1-800-657-2543.

DESKTOP CASES final blowout sale! They gotta go, gotta go! Baby AT desktop 235 watt \$28 ea. Turbo desktop case with 135/150 watt supply \$17 or \$21. Quantity discounts on cases and shipping! Call UTWE 818-930-1121 or fax 818-930-1123. 9am-5pm PST. These deals WILL GO FAST. Call and get your share!

Toner Cartridge Recharge

& Laser Printer Supplies



Three Ways to Earn Cash

You Do It Dealer Program 1

You do the recycling work, and we'll supply all the materials, training, and technical support.

- Supplies cost from \$6 each
- Free Directions
- 1 Free Video Training Tape
- Starter Kit approx. \$500 supplies for 36 recharges
- For complete information, see Fax document# 2040*

We Do It For You Dealer Program 2

You ship us your customer's toner cartridges and OPC cartridges, and we'll recycle them at a reduced price for you.

- Attractive Marketing Flyers with your name available
- Fast Turnaround
- Generic Packaging
- See Fax document# 2092*

We Do It For Your Customer Dealer Program 3

You recommend us and give literature with our name to your customer. We'll deal direct with your customer. You have your code on our prepaid shipping label.

- You earn commission
- You recommend us
- Prepaid UPS shipping labels
- For complete information, see Fax document# 2090*

*To obtain Fax documents, use our Fax-On-Demand system. Call 516-467-0772 from any Fax machine equipped with a touch-tone phone, 24 hrs/day, 7 days/week. Dial document# 4633 for an index.



Cheneko Products Inc.
2221 5th Ave., Suite 4, Ronkonkoma, NY 11779
Phone: 516-467-3205 E-mail: cheneko@aol.com
Fax: 516-467-3223 Fax-On-Demand: 516-467-0772

800-221-3516

Write in 134 on Reader Service Card.

COMPONENTS: Motherboard and CPU, 486DX/266 \$149, 486DX/4100 \$200, 486DX/4120 \$229, Pentium 75 \$349, P100 \$439, 4MB RAM \$140, 8MB \$275, 1 GIG \$265, 2xCD \$89, 4xCD \$129, 6xCD \$189. Items new, year warranty. Shipping \$5. **Electric Elephant**, BOX 1383, Sandusky, OH 44870.

DISK CONTROLLERS FOR THE IBM PC 8/16/32 bit MFM, RLL, ESDI, SCSI, IDE, and CD-ROM too! Call UTWE with your needs. DTC3274 VESA local bus SCSI 2 controller \$95 NEW with all docs and drivers (including ASPI). New 16 bit 1:1 MFM \$20 ea., cables add \$2.50. Adaptec ESDI 2322B \$25. Call for 8 and 16 bit SCSI interfaces! Call (open 9am-5pm PST) 818-930-1121 or fax 818-930-1123.

STEREO SOUND CARDS FOR 286-5861 Maestro Pro Sound Blaster Pro 2 and Adlib compatible. Includes CD-ROM interface. Can use upper IRQ lines. Includes all manuals and software! Software configurable! Sound Blaster 16 compatible! \$32 each, limited to stock on hand! True 16 bit Wave table version with Adaptec full SCSI interface \$70. (Open 9am-5pm PST) Call UTWE 818-930-1121 or fax 818-930-1123.

PIC Programmer Development Tools

- Programmer for PIC 16C5X, 16C6X, 16C7X, 16C84, and 17C4X in DIP packages.
- Conditional Assembler and Simulator.
- Emulates program memory, registers, and I/O for the PIC 16C5X.
- Instruction-level emulation for the PIC 16C71 and 16C84.
- Programmer only \$155, Complete package \$245. 15 day money-back guarantee.

Low cost Microcontroller Development Systems

80C552, 80C31, and 68HC11 development systems include single board computer, assembler, disassembler, real-time execution and debugging, monitor program, and examples.

ROMY-16 EPROM EMULATOR

Emulates ROM or RAM in 8- and 16-bit systems. \$195 (2716-27256) or \$245 (2716-27010). Window/menu driven interface. 15 day money-back guarantee.

J&M Microtek, Inc.
83 Seaman Road, W Orange, NJ 07052
Tel: (201) 325-1892 Fax: (201) 736-4567

PROFESSIONAL COUNTERSURVEILLANCE EQUIPMENT

AI 6600
Phone Tap Detector
Detects:
• Radio Frequency Taps
• Series and Parallel Taps
• Line Impedance Taps
• Extension Phone Listeners
\$149.95



AI 2100
VIBRATING TRANSMITTER DETECTOR
Detects:
• Body Wires
• FM Wireless Mics
• AM Transmitters
• UHF Transmitters
\$189.95

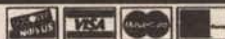
AI 5500
COMPLETE SAFETY SYSTEM
Detects:
• All Phone Taps and Extension Phone Listeners
• All Body Wires, Wireless Mics, AM, FM and UHF Transmitters
Defeats:
• All Body Wires, Transmitters and Distance Microphones with its built in white noise signal breaker
\$379.95



We sell a variety of covert cameras, transmitters, night vision equipment, video transmitters, time lapse recorders, remote video monitoring systems, body armour, and much more...

Request Our Full Catalog for \$5.00, Receive \$10.00 OFF First Order (FREE WITH ANY PURCHASE)

AMERICAN INNOVATIONS, INC.
119 Rockland Center Suite 315 Nanuet, N.Y. 10954
914-735-6127 • Fax 914-735-3560



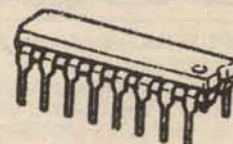
Write in 95 on Reader Service Card.

HEWLETT PACKARD calculators. We buy, sell and trade 41C, CV, CX, 100LX, 200LX, palmtops and 71B calculators and portable printers. Phone: 610-588-2600. FAX 610-588-1727.

HALF PRICE! Our popular 35 page report "Getting Started in Computer Telephony" is now only \$9.95! **COMPUTER TELEPHONY**, the integration of the computer and telephone, is the fastest growing segment of the communications industry. Our report explains all of the technical data, business strategies, and lucrative opportunities in this field. Harmony Products, PO Box 91, Netcong, NJ 07857.

NEC 5D 20 in. monitor \$550, IDEK 21 in. monitor \$550. 414-452-3803 evenings or jdufon@excel.net

AUTHORIZED ZENITH and Compaq parts and repairs. Excess inventory: 220 volt European power cords, 84 key ZDS keyboards. We have over \$1,000,000 worth of parts. \$250 for repair of ZDS, XT, and 286 laptops. Call for details. Domino Computers, 708-427-0099, FAX 708-427-8181. Hours: M-F 9-5 Central time. We accept all major credit cards. We ship UPS or Fedex. We blind ship.



WANTED: EXCESS ELECTRONIC INVENTORIES, ICs, MEMORY, EPROMs, PALs, LEDs, CIRCUIT BOARDS, DIODES, AND TRANSISTORS. CALL ACTIVE MICRO, 310-494-4851 OR FAX 310-494-4913.

CHAFFIN ELECTRONICS INC. Call us for all your IC needs. Let us save you \$\$\$\$. Call Sales 614-574-4456, Sales 614-574-6906, FAX 614-574-2124.

HP PLOTTER, 7475A, 6 pen, A & B Size paper, with cables. Serial or HP-IB interface available, \$395. DEXIS, 612-944-7670.

COMPUTERS, ACCESSORIES, BELOW WHOLESALE! EXCELLENT BUSINESS OPPORTUNITY! Direct from foreign manufacturers. Anyone can! Large quantities not required. Complete step-by-step guides, addresses, tips, etc. \$12 postpaid. SMI, PO Box 2800-C, Hendersonville, NC 28793.

ANALOG/DIGITAL I/O CARDS from \$29. Up to 8 different boards can be operated simultaneously from your PC's printer port. Available boards include 24-bit A/D converters, 12-bit DACs, LCD displays, relays, digital I/O, thermocouples, etc. Atlantic Technologies, Inc., POB 26, Newtown Square, PA 19073.

HELP! I need to copy a PROLOK (R) UNILOK (TM) protected diskette for private archival purposes. Phone me collect 715-627-4234, after 6:00 PM CST. Ray Heckert, W11816 Spring, Antigo, WI 54409.

COMPUTER FOR sale: Compaq 386 S/20 6MG. RAM, Conner 212 & 84 MG hard drives, math coprocessor, 3.5 floppy drive, 1 serial & 1 parallel port, 4 expansion slots, VGA controller. \$300. 201-743-3125.



120MB or 250MB TAPE BACKUP DRIVES by COLORADO for only \$25 or \$45. Works from floppy disk controller in any PC, from XT to Pentium. Tapes available. Backup 120MB hard disk in 14 min. Use multiple tapes to backup any size drive. DOS and Windows software. The best protection from disk crashes, viruses, theft, accidental erasure. Guaranteed. Equiptek, 415-244-9438 9-5 PST.

COLORADO TRAKKER tape back-up ext. 250MB \$80, 350MB \$95, 700MB \$125. Inter. 120MB \$25, 250MB \$50, 350MB \$65, 700MB \$100. 1.4 gig \$150. Refurbished w/90-day warranty. UPS daily. Servo-Track 408-378-1374.



Digicom Communications, Inc.
Importing & Exporting Nation Wide

\$ \$ \$ \$ \$

The Only Company
That Carries The Newest 1996 Items,
At '95 Prices

New 96 Quickboards
SA: 8570-8600 \$13
Micro: 8570-8600 \$13
99ch Data Modules for
8500-8536 \$4
8550 \$7

New Dropfield Three Wire
Data Modules For 8500-8536
\$5
New Two wire data for new
'96 converters. No brakes or
jumper cuts.
Zenith Z-Tac Modules ST-1000,
ST-1086, ST-1600 Etc. \$5

**We Have Many Other
Products Not Listed.**

**Ask For Our Free
Catalog.**

**30 pc. Minimum
Order**

Sorry no Florida Sales

1-(800)-250-3187
Tel/Fax: 1-(305)-638-9392

HIGH-SPEED PLOTTER: HP 7550A 8-pen plotter w/extra magazine \$195. ALSO: FUJITSU DL-5600 wide carriage printer \$95. 802-860-1180.



COMPUTER VIRUSES: This is perhaps the largest collection in the world! **Contains over 4,000 LIVE viruses on disk!** Many are undetectable. Includes: Jerusalem, Michaelangelo, T-Rev, Dark Avenger, Cancer, CIA, Erasure, Stoned II, Rabad, Arpa Virus, Bat Virus, Killer, Stoned V, Bad Boy, Flu, Darth Vader, Blood, Screamer, Gotcha, Datalock, Lockjaw, and lots more! For educational use only! Software \$23. **SPECTRE PRESS**, PO Box 5112, N. Muskegon, MI 49445.

PENTIUM MOTHERBOARDS 75/100/120/133/150/166, Triton chipset, Plug-N-Play BIOS, highest performance Pipeline Burstmode cache, 4 each ISA/PCI slots, cache module socket, 0K cache \$129, Pipeline Burstmode cache module \$60. Pentium CPUs @ \$177/236/315/396/535/794. 486 boards with 3VLB, DX4-30/2-72 SIMM sockets, DX2/66 CPU, WB cache \$109, 256K 15ns cache \$129, DX4/100 CPU \$179, PCI version with EIDE/IO, 4-72 pin SIMM, add \$14. Acer QuadSpeed CD-ROM, Audio front panel \$99, 72-pin SIMMs, 70ns, 4MB-\$109, 8MB-\$209. Call for other PC parts and illustrated catalog. 1 year warranty, FOB tech-specialties, inc., 909 Crosstimbers, Houston, TX 77022-3903, 1-800-864-5391 for orders and tech support, fax: 713-691-7009.

CDs, FLOPPIES & VHS VIDEOS. Thousands of titles. CDs as low as \$5. Videos as low as \$8. Request "Software Flyer" free with monthly specials! Titles from family to adult. Credit cards accepted. Write or fax 501-223-9406. **Software City**, Box 23016, Little Rock, AR 72221.

CAN'T COPY Windows 95 disks? I can! Program lets you make unlimited copies of any floppy regardless of format or copy protection. Send \$10 to C21 Shark Soft, 6901 W. Broward Blvd. #101, Plantation, FL 33317. We'll rush complete program and instructions on 3.5 disk.



UJ'S® CELLULAR EMULATOR SYSTEM, COMBO SALE, MARCH, APRIL, AND MAY, INCLUDES FREE, MOTOROLA'S NEW CELLULAR TECHNICIANS TRAINING MANUAL (212 PAGES OCT. '95). ALSO SALES, REFURBISHED CELLULAR PHONES. SEE OUR DETAILED ADS IN TELEPHONE/FAX CLASSIFICATION. LESS BUSTER'S ELECTRONICS, 702-642-0325.

LAPTOP SPECIALS complete systems available 5xCD-ROM only \$140, 4xCD-\$120, 4 Meg 72 pin \$30 486 upgradeable motherboards \$85, CPUs 66-\$38, 80 \$45, 100-\$95, 120-\$110 Pentii Triton motherboards \$150, CPUs 75-\$170, 90-\$250, 100-\$298, 133-\$525 1.2 GIG Conner HD \$265 keyboards, Enhanced 101-\$17, Mouse \$8 Labtek 150 Speakers \$12 Modem Internal 28.8-\$115. Call 717-275-0666 or WWW.RJELC.COM Orders 1-800-657-2543.

DIGELEC, MODEL 824 EPROM programmer, will work as a stand-alone programmer or with connection to serial port on IBM computer. All manuals, cables, and software included. Paid over \$1K, will sell for \$500. Jerry 806-256-3405, if no answer leave message.

VGA COLOR monitor kit \$35 ea. Includes IBM #5272 monitor and all parts and instructions for the conversion. 10 or more \$28 ea. PC Parts, 717-232-4494, 717-230-9570 FAX.

WHOLESALE DIRECT BUYERS CLUB! Brand name computer products. **ALL NEW EQUIPMENT, ALL AT COST!** 3.5" FLOPPIES \$27, 2X CD-ROM DRIVES \$59, 386 COMPUTER + MONITOR \$249, 420MB HDD \$138, 14.4 FAX/MODEM \$38, 3.5" DISKS .23, and much more. **Members receive 1-800 access line. Only \$15/month to join.** (SPECIAL: 6-month membership fee \$49) **BRINKER ENGINEERING LABS**, Suite 119-A, Box 348, Ellaville, GA 31806-0348.

DIGIBOARD, MODEL DigiCHANNEL PC/16e, with 16 port host adapter, 16 bit Novell board, software, and cable. Works great, used very low hours. Jerry 806-256-3405, if no answer, leave message.

HP X&Y MOTOR/ENCODER ASSY (NEW) for HP Draftmaster plotter. \$100 pair. Qty's available. 619-632-9775.

PROGRAMMERS BY AMS, TRIBAL & KEL-TEK E(E)PROMS, Flash, GALs/ micros \$125 up. Systems including PICs & erasers. 24 hr. FREE BBS updates for clients. **History: 24 yrs. client satisfaction. TRIANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390. M-F 9am to 2pm EST.

4 HP 6942A extender boxes. There are 33 various cards \$300 a box. Contact Ty Miller, Southcoast Surplus, 714-830-9170.

COMPUTERS 386 & 286 plug-in play w/1.2 floppy drives, 20/40 meg hard drive, 640K mem. Keyboard & more, AT286 \$98, AT386-16 2 meg RAM, \$198. Less monitors, 3.5" 1.44 drive \$35, 14" VGA monitors \$129. Flyer. Call/SASE. BNFE, Rte. 1S, Peabody, MA 01960. T508-536-2000, F508-536-7400. WWW.BNFE.COM Since 1964.

MONITOR ADAPTERS. Convert OEM. (incl. PGA) 31.5KHz & above monitors with BNC connectors to PC use. Model VA10 VGA to RGB+ Sync \$45. Model VA11 VGA to RG/Sync-B \$55. VA12 VGA to PGA (DB9) \$45. Rich, Pikul & Assoc., 101 Glenfield Dr., Festus, MO 63028. 314-937-0335.

MONITOR TECHNICIANS! 10 step program for successful analysis; diagnosis, and repair of high voltage and power supply problems in computer monitors. Booklet available for \$20 from Computer Vision, 6905 Indian Bay Rd., Montague, MI 49437.

INKJET REFILL Resource Kit. Refill your cartridges like the pros @ 20% replacement cost. OEM guide. Tips, refill techniques and specifications covers hundreds of inkjets \$10 postpaid. Premium 5X color refill kits \$29 & up. Silicon Resource, 914-339-8802.

ALFA ELECTRONICS

HIGH QUALITY TEST EQUIPMENT
BEST PRICE



DMM 89 \$179.00
Most Advanced DMM
All Purpose & Communication
-80.7 to 81.4 dBm with 40-1200Ω
20 reference impedances
True RMS
Frequency counter: 0.01Hz-10MHz
Capacitance: 1pF-50,000μF
Measure AC volt to 20kHz
5000 counts, 0.1% accuracy
Auto/manual range, fast bar graph
Min/Max/Ave/DH/Relative/Zoom
Auto power off
Input warning
Splash proof
Volt, amp, ohm, logic, diode, continuity
Ruggedized case
Rubber holster included



DMM 2360 \$119.95 NOW \$109.95
DMM+LCR Meter
Inductance: 1μH-40H
Capacitance: 1pF-40μF
Frequency: 1Hz-4MHz
Temperature: -40-302°F
TTL Logic Test: 20MHz
Diode, Continuity
Volt, Amp, Ohm
3999 count display
Peak Hold
Auto power off
Ruggedized case
Temperature probe included



DMM 20 \$74.95
Inductance: 1μH-40H
Capacitance: 1pF-200μF
Frequency: 1Hz-20MHz
Volt, amp, ohm, diode, 20 Amp AC/DC current
Transistor HFE
Continuity, duty %
Peak hold/Max
Ruggedized case
Rubber holster \$8.00
Full line of DMMs, economy, compact, ruggedized, solar cell, automotive, heavy duty, industrial, starts from \$19.95

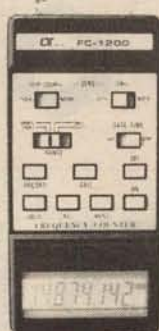
Fiske Multimeter
Fiske 12 \$84.95
Holster C-10 \$10
Fiske 70 II \$75.95
Fiske 73 II \$97.50
Fiske 75 II \$129
Holster C-70 \$16
Fiske 77 II \$155
Fiske 79 II \$175
Fiske 29 II \$175
Fiske 76 \$175
Fiske 87 \$287
Fiske 867 \$1199
Fiske 97
Scope Meter \$1785
Fiske 105
Scope Meter \$2799



LCR Meter 131D \$229.95
Most Advanced LCR
Dual display: L/Q or C/D
Inductance: 0.1μH-1000H
Capacitance: 0.1pF-10,000μF
Impedance: 1mΩ-10MΩ
0.7% basic accuracy
Auto/manual range
Dissipation factor & Q factor
Serial & parallel mode
Relative mode for comparison
and to remove parasitics
Statistics, tolerance,
Best for design, incoming
testing & production
SMD and chip component
test probe \$25.00



LCR Meter 814 \$189.95
Best Resolution LCR
Inductance: 0.1μH-200H
Capacitance: 0.1pF-20,000μF
Resistance: 1mΩ-20MΩ
1% basic accuracy
Dissipation factor indicates leakage
in capacitor and Q factor in inductor
Zero adjustment to reduce parasitics
Best for high frequency RF
SMD and chip component test probe
\$25.00
LIMITED QUANTITY SPECIAL
DIGITAL LCR 680 \$74.95
0.1pF, 1μH, 10mΩ resolution

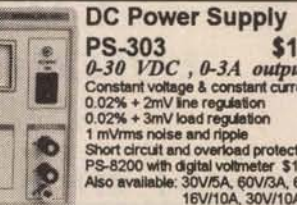


Frequency Counter FC-1200 \$129.95
Frequency: 0.1Hz-1.25GHz
Display: 8 digit LCD
Period: 0.1μs-0.1s
Records: Max/Min/Average
Data hold, relative mode
Telescoping antenna \$8.00
Deluxe case \$5.00
Also Available:
AC/DC clamp meter, Light meter,
Thermometer, pH meter, High
voltage probe, Digital caliper,
Anemometer, Electronic scale,
Force gauge, Tachometer,
Stroboscope, Humidity & EMF
adapter, Sound level meter,
Frequency counter, SWR/field
strength/power meter, Dip meter



20 MHz Oscilloscope with Delay Sweep PS-205 \$429.95
Dual Trace, Component test, 8" CRT, X-Y Operation, TV Sync, Z-Modulation, CH2 Output, Graticule Illum, 2 probes each has x1, x10 switch. Best price with delay sweep.
PS-200 20 MHz DUAL TRACE \$339.95
PS-400 40 MHz DUAL TRACE \$494.95
PS-405 40 MHz DELAY SWEEP \$589.95
PS-605 60 MHz DELAY SWEEP \$789.95
PS-1000 100 MHz DUAL TRACE \$999.95
Scope Probe: 60MHz x1, x10 \$15, 100MHz x1, x10 \$22, 250MHz x1, x10 \$28, 250MHz x100 \$39

Digital Storage Scope DS-303 30MHz, 20M Sample/sec \$849.95
DS-303P with RS-232 interface \$1,049.95
Switchable between digital and analog modes
2 K word per channel storage
8 bit vertical resolution (25 Level/div)
Expanded Timebase 10ms/div - 0.5 s/div
Refresh, Roll, Save all, Save CH2, Pre-Trig
Plotter control



DC Power Supply PS-303 \$159.00
0-30 VDC, 0-3A output
Constant voltage & constant current mode
0.02% + 2mV line regulation
0.02% + 3mV load regulation
1 mVrms noise and ripple
Short circuit and overload protected
PS-8202 with digital voltmeter \$179.00
Also available: 30V/5A, 60V/3A, 60V/5A
16V/10A, 30V/10A

DC Power Supply Triple Output PS-8202 \$499.95
Two 0-30 VDC, 0-3A outputs
One fixed 5VDC, 3A output
Capable of independent or tracking operation
Constant voltage and constant current mode
Four digital meters for volt and current display
Excellent regulation and low ripple
Short circuit and overload protected
Also available: 30V/5A, 60V/3A, 60V/5A
Dual tracking 30V/3A, 30V/5A, 60V/3A, 60V/5A



RF SIGNAL GENERATOR SG-4160B \$124.95
100 kHz-150MHz sine wave in 8 ranges
RF Output 100mVrms to 35 MHz
Internal 1kHz, External 50Hz-20kHz
AM modulation
Audio output 1 kHz, 1 Vrms

AUDIO GENERATOR AG-2601A \$124.95
10Hz - 1MHz in 5 ranges
Output: 0-8Vrms sine wave
0-10Vp-p square wave
Synchronization: ±3% of oscillation
frequency per Vrms
Output distortion:
0.05% 500Hz - 50kHz
0.5% 50Hz - 500kHz
Output impedance: 600 ohm



FUNCTION GENERATOR FG-2100A \$169.95
0.2 Hz - 2 MHz in 7 ranges
Sine, square, triangle, pulse and ramp
Output: 5mV-20Vp-p
1% distortion, DC offset ± 10V
VCF: 0-10V control frequency to 1000:1

FUNCTION GEN/COUNTER FG-2102AD \$229.95
Generates signal same as FG-2100A
Frequency counter 4 digits
Feature TTL and CMOS output

ALFA ELECTRONICS
741 Alexander Rd., Princeton, NJ 08540

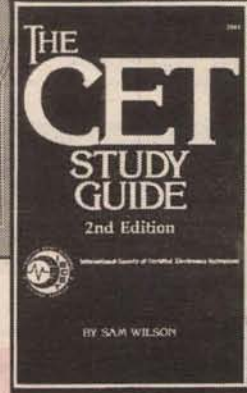
(800) 526-2532/(609) 520-2002 15 DAY MONEY BACK GUARANTEE. 1 YEAR WARRANTY
FAX: (609) 520-2007
Visa, Master Card, American Express, COD, Purchase Order Welcome
CALL OR WRITE FOR FREE CATALOG AND BEST OFFER.

Knowledge is Power!

MCM Electronics®

With electronics, you know accurate information is a must. Gain the advantage of this information through the research and expertise available to you today. Call MCM. Your selection includes a wide variety of books, software and video tapes on specific topics including TV, VCR and computer repair, speaker design and autosound installation. All are stocked! You can even get the entire offering of Sams Photofacts.

MCM is the #1 source for all of your electronics needs. Test equipment, repair parts, semiconductors, tools, chemicals and computer products, over 21,000 products in all, are stocked and ready to ship. Whether you need information, quality tools and test equipment or a wide variety of parts and components, MCM has what you need.



FREE Catalog!

Call Toll Free

1-800-543-4330

Hours: M-F 7 a.m.-9 a.m., Sat. 9 a.m.-6 p.m. EST



MCM ELECTRONICS®
650 CONGRESS PARK DR.
CENTERVILLE, OH 45459-4072
A PREMIER Company

Authorized Original Parts Distributor

Panasonic
Quasar/Technics

MCM is a

RCA / **GE**
Premier Distributor

Get fast delivery from our Distribution Facilities near Dayton, OH and Reno, NV!

CODE:NVM06

Write in 133 on Reader Service Card.

Software Clearance Outlet

Math Blaster	\$19 ⁹⁵
Corel Ventura 5	\$99 ⁹⁵
Corel Draw 4.0 CD Rom	\$99 ⁹⁵
Star Trek 25th Anniversary	\$10 ⁹⁵
Virtual Pool CD	\$10 ⁹⁵
Norton Utilities 8.0	\$79 ⁹⁵
Floorplan + 3D / Windows	\$10 ⁹⁵
Lion King Print Kit	\$10 ⁹⁵
Windows 3.0	\$19 ⁹⁵
Star Trek Judgement Rites	\$10 ⁹⁵
Windows 95 upgrade	\$79 ⁹⁵
Dos 5.0	\$14 ⁹⁵
Falcon Gold CD	\$29 ⁹⁵

Corel Office Companion
15,000 Clipart Images-500 fonts
CorelFLOW2-CorelFAX-CorelWEB-
CorelPLANNER-Bookcase
\$49⁹⁵

MS Dos 6.22
Upgrade version of 6.0
with free setup to 6.22
\$29⁹⁵

Fax Works Pro 3.0
for Windows
with OCR \$19⁹⁵

QEMM 7.0 \$24⁹⁵
Gets you more memory
QEMM 7.5 \$39⁹⁵

New Products in everyday
call for availability and our
free catalog or surf our Web Site @
WWW.SoftwareOutlet.com

MACINTOSH also Available

3501 W. Moore Ave. #C Open 10-8 Mon-Fri
Santa Ana, CA 92704 Open 10-6 Sat-Sun
Fax (714) 434-4799 (714) 434-4797

1-800-230-SOFT
(7638)

Quantities are limited. Compatibility not
guaranteed. No Returns on used or opened
Merchandise. Returns must have an
Authorization Number! Defective products will
be replaced with identical items. Add \$6 min.
for Shipping. Policies, Availability, and Prices
subject to change without notice.

We also Buy New Software and Closeouts
Call (714) 434-4797 or Fax (714) 434-4799



486DX-133 VLB motherboard w/CPU, fan, \$189. **486DX-100 VLB** motherboard w/CPU, fan, \$149. **SIMMs** converters sty A & B, \$18, \$65/4. 16 bit Boca sound impression card w/14.4 voice/fax/data/modem, for IDE + 3 other drives \$79, \$225/3. 17" HP/Sony workstation monitor fix freq. 66Hz VRR 1280 x 1024 x .31 DP w/cable \$199. **486DX33** by DEC workstation barebones drives above monitor, see last month's ad. \$179. See flyer, Send SASE: BNFE, Rte. 1S, Peabody, MA 01960. WWW.BNFE.COM V508-536-2000, F508-536-7400. Since 1964.

IPM 600VA 120VAC single phase on-line true sinewave UPS. 20-minute battery at 420 watts. New in original box. \$350. 714-843-6476.

VGA MONITOR \$125. EGA/CGA monitor \$60/\$40. 386 computer \$250, 286 computer \$100, Epson printer \$40, XT computer \$45, HP Think Jet printer \$60, much more. Call 714-827-7345.

TEKTRONIX 4693D Color Image Printer 300 DPI, new \$8,995, asking \$995 with supplies. DEXIS, 612-944-7670.

ADD FAX TO YOUR PC CHEAP! 9600 baud fax and 2400 baud modem internal only \$15 each, 5 for \$60 or 10/\$100. Need more? Call for price. Great for a dedicated machine! Call and deal! (Open 9am-5pm PST) Under The Wire Electronics, 818-930-1121 or fax 818-930-1123.

COMMODORE AMIGA 500, IBM monitor, power supply, mouse, joystick, connecting cables and manuals. Many software titles/manuals. Working, and clean. Collector grade. Firm price. \$100 + shipping from NH. 603-474-3645 6pm-9pm EST.



CABLE TV UNIVERSAL Descrambler NEW PRODUCT



MODEL 5000 Fully Assembled \$199.95
Our fully assembled product is factory tested and **GUARANTEED** to work on your system. We will also include an AC power adaptor and complete hookup instructions. This unique product will be available for a limited time only!

4000 And 5000 Features

- The latest in Video Amplification Technology.
- New clocking circuits to stabilize color and the picture performance.
- The most advanced picture locking circuitry.
- Inverted Video Option is available.
- Connects easily to the VCR.
- **NO CONVERTER BOX** is necessary.

MODEL 4000 KIT \$79.95
The 4000 KIT comes with all the electronic components and our Cad designed PC board. We provide a schematic, parts list, wiring diagram, tutorial and **FREE** in-house support.

MODEL 4000A Enc. \$44.95
The 4000A Enclosure Package will provide the hobbyist, who has our 4000 Kit, a custom enclosure, AC adaptor and finish accessories to professionally enclose their kit.

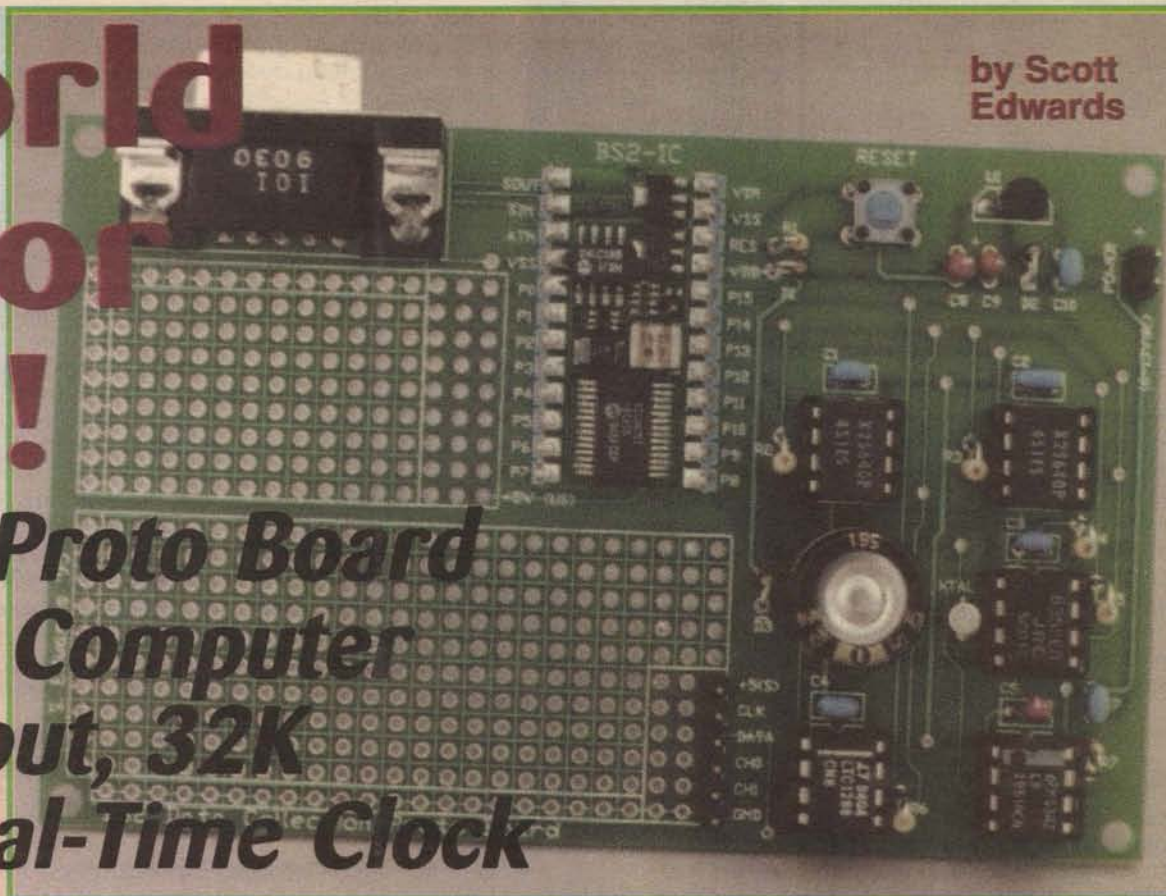
CALL THE HALCYON GROUP 1-800-664-6999

NO Florida Sales! Anyone implying theft of cable service will be denied assistance.

Real-World Power for the BS2!

by Scott Edwards

Data Collection Proto Board for the Stamp II Computer Adds Analog Input, 32K Storage, and Real-Time Clock



The BASIC Stamp II (BS2) microcontroller is a great project just waiting to happen. Although it's no bigger than a standard 24-pin IC, it can:

- Measure and generate pulses and frequencies, including "touch" tones.
- Wirelessly control appliances through an X-10 powerline interface.
- Send and receive data via RS-232 at standard speeds up to 38,400 baud.
- Control 16 general-purpose digital input/output (I/O) lines.

- Sleep for timed intervals, reducing current draw to less than 0.5 mA.
- Run BASIC programs up to 500 instructions long.

With these capabilities, and a price tag of just \$49.00, the BS2 has attracted a large and loyal following since its introduction last fall (see the first-peek article in the Sept. '95 issue of *NEV*). But now there are signs of discontent. See, there are a few features that the BS2 doesn't have, and that users have been struggling to add to their projects: data storage, analog input, real-time clock, and

(most importantly) the design information needed to make it all work.

As readers of my Stamp Applications column here in *NEV* know, I take the wish lists of Stamp users very seriously. And this time, I've incorporated those wishes into a single printed circuit board: the BS2 Data Collection Proto Board. It features:

- Up to 32 KB of EEPROM data storage.
- Real-time clock/calendar.
- Two-channel, 12-bit analog-to-digital converter.
- Software-controlled peripheral power supply.
- Support for three-wire synchronous serial bus devices.
- Eight uncommitted digital I/O lines.
- Prototyping areas for additional circuitry.

In this article, I'll describe the Proto Board's hardware features and introduce an example application that pulls them all together—a data logger that takes a pair of precision voltage measurements each minute and stores them, along with the exact time of the measurement, into the board's storage memory. Even if you don't plan to use the Proto Board, you'll gain valuable insight into using peripherals with the BS2.

Hardware Overview

Because of its IC-style packaging, the

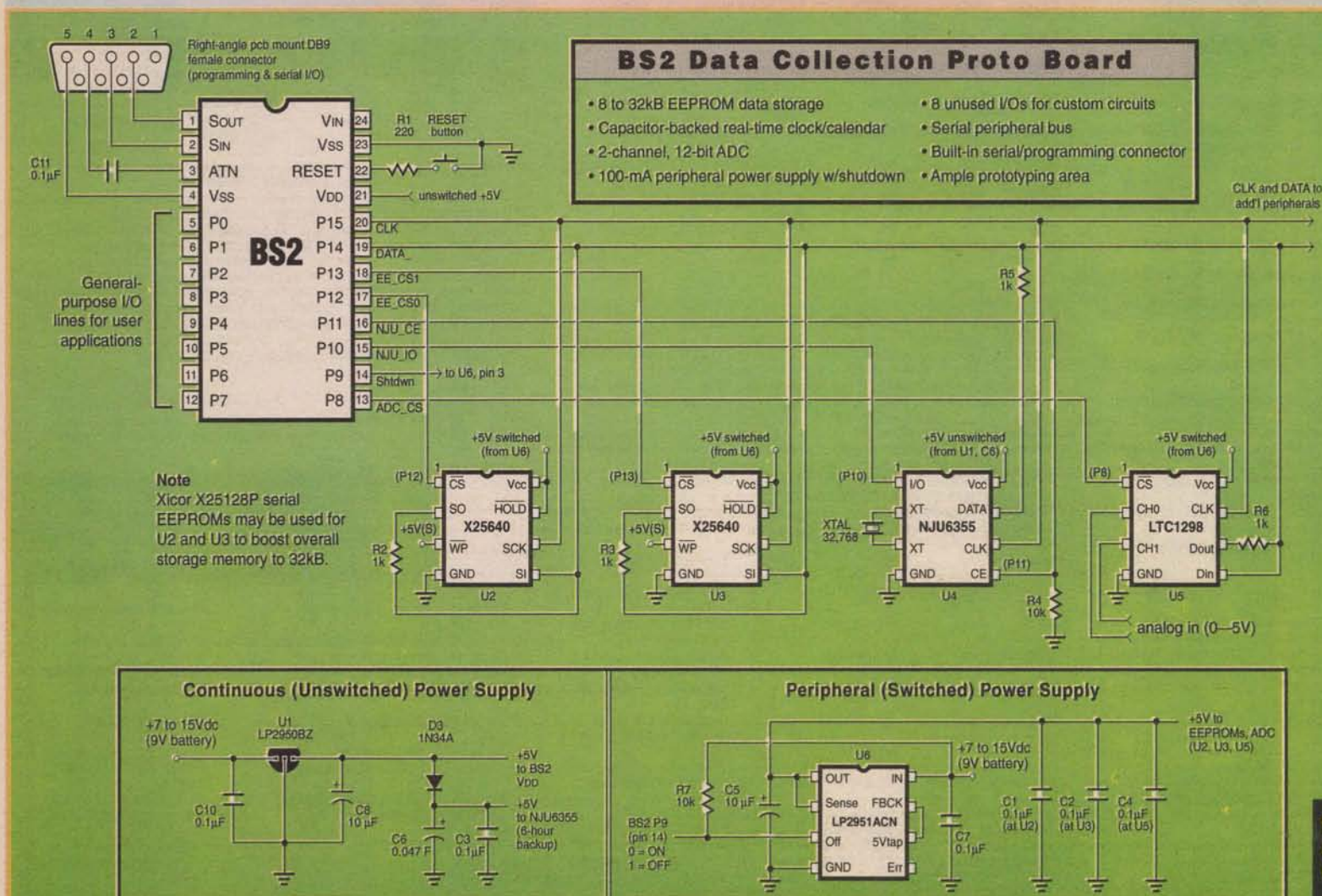


Figure 1. Schematic diagram of the Data Collection Proto Board.

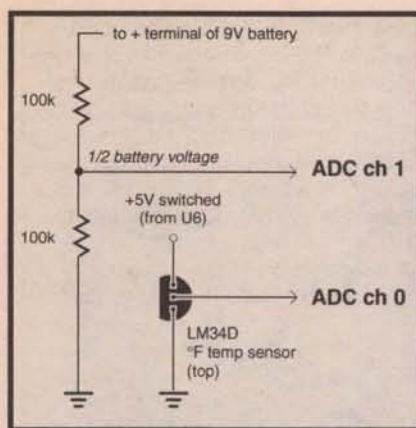


Figure 2. Sensors for demo run of data-logging program. The resistor voltage divider cut the 9V battery output in half to fit within the ADC's 0-5V range. The LM34's output voltage changes by 10mV for each 1°F change in temperature.

BS2-IC requires a carrier board for convenient connection to peripherals, sensors, and outputs. The manufacturer (Parallax; Sources) offers a generic carrier board, consisting of a programming connector, battery clips, reset button, and grid-of-holes prototyping area. The Data Collection Proto Board extends this concept by putting commonly needed peripherals onto the carrier board. Figure 1 is a schematic of the board; Table 1 is a parts list. Here's a rundown of the hardware features:

Main (Unswitched) Power Supply. The BS2-IC has a 5 V, 50 mA voltage regulator built in. This regulator is adequate for powering the BS2 itself, but can't supply enough current for more than a few peripherals. Early BS2 models experienced failures of this regulator due to minor errors like touching the battery to the power terminals backwards. For flexibility and reliability, the Proto Board provides a 5 V, 100 mA regulator, consisting of U1 and associated components.

Peripheral (Switched) Power Supply. The Proto Board places a second 5 V, 100 mA power

supply under the control of a BS2 I/O pin (P9). This lets an application conserve power by shutting down portions of the circuit. Since the peripherals (EEPROM, ADC, clock) draw, at most, a few mA, almost all of the regulator's capacity is available for additional circuits.

Synchronous Serial Peripheral Bus. The BS2 has instructions for communicating with peripherals that use a three-wire serial interface. The Proto Board assigns two I/O pins (P15 and P14) as dedicated clock and data lines to be shared by all standard or user-installed serial peripherals. To talk to a peripheral on the bus, the program activates the device's chip-select or enable line, then sends or receives data using the BS2 instructions Shiftin and Shiftout.

Solid-State Data Storage. The Proto Board accommodates 8 KB to 32 KB of EEPROM (electrically erasable, programmable, read-only memory) for storing data. The board holds two X25640P (8 KB each) or two X25128P (16 KB each). These devices may be read and written like RAM, but retain data with power off. This makes it possible to recover data recorded by a system whose power has failed. EEPROMs eventually wear out after repeated writes, and should be replaced after 100,000 write cycles. Put in perspective, writing each address of 32 KB of EEPROM at one byte per second would take 104 years to wear out the EEPROMs.

Real-time Clock/Calendar. An NJU6355 clock/calendar chip keeps track of the current time, date, and day of the week. Data from the clock may be used to time tag data recorded to EEPROM, or factored into program decisions (e.g., weekday vs. weekend in a setback thermostat). Power to the clock chip is backed up by a large

capacitor, allowing it to keep time for 6 to 24 hours with system power removed.

Analog Inputs. An LTC1298 12-bit ADC (analog-to-digital converter) provides two analog voltage inputs with 1.22-millivolt resolution (five-volt range divided into 4096 units). Under software control, the inputs may be used as separate single-ended inputs (referenced to ground) or as one differential input. The ADC has a sample-and-hold feature that takes a snapshot of the input voltage at the instant of the measurement request, allowing it to sample noisy, or fast-changing inputs. Measurements are referenced to the peripheral power supply, which is exceptionally stable.

Expansion Capabilities and Standard BS2 Features. The Proto Board uses only the upper eight pins of the BS2's 16-pin I/O port. If your application requires more peripherals — say an additional ADC or digital thermometer chip — the shared clock and data lines of the serial bus are available through pads next to the lower prototyping area. Just assign one of the remaining eight I/Os as a chip-select or enable line, and write the necessary BASIC code to drive the device.

Like any BS2-based device, projects built around the Proto Board offer exceptional flexibility when it comes to driving other peripherals. The BS2 can send or receive RS-232-style serial through any of its I/O pins. As a result, there are a variety of asynchronous serial peripherals available for it, including LCD displays up to four lines by 20 characters; expansion boards that add 16 bits of digital I/O; even a board for driving radio-control positioning servos (see Sources for more information).

Don't forget the BS2's other capabilities, like X-10 appliance control and DTMF touch-tone output. Combined with large memory capacity, real-

Program Listing: Example Data Logger Program

Note: This program listing is available from the Parallax ftp site via the Internet, ftp.parallaxinc.com. It also comes on the disk that is included with most of the Data Collection Proto Board packages.

* Program: LOG_1.BS2
* This program demonstrates use of the BS2 Data Collection Proto Board in a typical data-logging application. It exercises all of the board's built-in peripheral devices, including two 8 KB (or 16 KB) EEPROMs, real-time clock/calendar, 12-bit ADC, and switchable precision power supply.

* [[NOTE: lines that were too long were split with the ~ symbol used to indicate continuation on the next line.]]

PIN ASSIGNMENTS, SYSTEM CONSTANTS, TEMPORARY VARIABLES

* The BS2's upper port, pins 8 through 15, is dedicated to the operation of the data-collection peripherals. The lower port, pins 0 through 7, is available for your application.

CLK	con	15	* Clock line for all serial peripherals.
DATA	con	14	* Data line for all serial peripherals.
EE_CS1	con	13	* Chip-select line for EEPROM 1 (U3).
EE_CS0	con	12	* Chip-select line for EEPROM 0 (U2).
NJU_CE	con	11	* Chip-enable for NJU6355 clock/calendar.
NJU_IO	con	10	* IO (read/write) for NJU6355; 1=write.
Shtdwn	con	9	* Shutdown for peripheral power supply; 1=off.
ADC_CS	con	8	* Chip-select line for LTC1298(88) ADC.
b96	con	\$54	* Baudmode for 9600 bps.
timeout	con	60000	* At startup, wait 60 seconds for serial command.
pwrOn	con	\$31	* Initial state of OUTH at peripheral power-up. Turns on LP2951, but deselects all chips.
temp	var	byte	* Temporary variable used in several routines.

SAMPLING CONSTANT(S)

smplSiz	con	8	* Each sample consists of 8 bytes—4 of data (2 ADC results in 16-bit words) 3 of time (12 BCD digits for hh:mm:ss) 1 checksum.
---------	-----	---	--

EEPROM CONSTANTS AND VARIABLES

WREN	con	6	* EEPROM opcode to enable writes.
RDSR	con	5	* EEPROM opcode to read the status register.
WRDI	con	4	* EEPROM opcode to disable writes.
ReadEE	con	3	* EEPROM opcode for read.
WriteEE	con	2	* EEPROM opcode for write.

* In the lines below, use the EESize constant that matches the

* EEPROM memory installed on your board. Delete or comment out the other EESize constant. This example uses X25640s, which have a capacity of 8191 bytes per chip.

EESize	con	16383	* Number of bytes per EEPROM (X25128).
EESize	con	8191	* Number of bytes per EEPROM (X25640).
EEmax	con	32768	* Total EEPROM capacity (X25128).
EEmax	con	16384	* Total EEPROM capacity (X25640).
EETop	con	EEmax-smplSiz	* Last EE address with room for sample.
EEaddr	var	word	* EEPROM address for reads and writes.
EEsel	var	bit	* EEPROM select (0 or 1) for address.
EEdata	var	byte	* Data written/read to/from EEPROM.
EEstats	var	byte	* Copy of the EEPROM status register.
EEbusy	var	EEstats.bit0	* EEPROM busy bit (1 = busy).
EEcksum	var	byte	* Checksum for EEPROM reads and writes.
EEincr	var	bit	* If = 1, increment EEaddr after each write.
EENoCk	var	bit	* If = 1, don't do checksum for 1 EE read.
EEblank	var	bit	* If = 1, then a series of EEreads was 0.

LTC1298 ADC CONSTANTS AND VARIABLES

* The LTC1298 is a 12-bit ADC that measures 0-5 volts, referenced to the 5-volt output of the peripheral power supply (LP2951).
* The 1298 has two modes. As a single-ended ADC, it measures the voltage at one of its inputs with respect to ground. As a differential ADC, it measures the difference in voltage between the two inputs.
* The sglDif bit determines the mode; 1 = single-ended, 0 = differential.
* When the 1298 is single-ended, the oddSign bit selects the active input channel; 0 = channel 0 (pin 2), 1 = channel 1 (pin 3).
* When the 1298 is differential, the oddSign bit selects the polarity between the two inputs; 0 = channel 0 is +, 1 = channel 1 is +.
* The msbf bit doesn't matter in this application, and is set to 1 by the same logical OR that sets the start bit in the ADC subroutine.

ADcnfg	var	nib	* Stores configuration bits for ADC.
ADres	var	word	* Variable to hold 12-bit AD result.
ADstb	var	ADcnfg.bit0	* Start bit for comm with ADC (always 1).
ADmode	var	ADcnfg.bit1	* Single-ended (1) or differential (0).
ADch	var	ADcnfg.bit2	* Channel or + selection (0 or 1).
ADmsbf	var	ADcnfg.bit3	* Output 0s after xfer (doesn't matter).

NJU6355 CLOCK/CALENDAR CONSTANTS AND VARIABLES

* The NJU6355ED clock/calendar chip maintains a 13-digit BCD account of the current year, month, day, day of week, hour, minute, and second. The clock subroutines transfer this data to/from a 13-nibble array in the BS2's RAM called "DTG" for "date/time group." The constants below allow you to refer to the digits by name; e.g., "Y10s" is the tens digit of the year. Note that there's no "am/pm"

* indicator—the NJU6355 uses the 24-hour clock. For instance, 2:00 pm is written or read as 14:00 (without the colon, of course).

Y10s	con	1	* Array position of year 10s digit.
Y1s	con	0	* " " " year 1s " "
Mo10s	con	3	* " " " month 10s " "
Mo1s	con	2	* " " " month 1s " "
D10s	con	5	* " " " day 10s " "
D1s	con	4	* " " " day 1s " "
H10s	con	8	* " " " hour 10s " "
H1s	con	7	* " " " hour 1s " "
M10s	con	10	* " " " minute 10s " "
M1s	con	9	* " " " minute 1s " "
S10s	con	12	* " " " second 10s " "
S1s	con	11	* " " " second 1s " "
day	con	6	* " " " day-of-week (1-7) digit.
digit	var	nib	* Number of 4-bit BCD digits read/written.
DTG	var	nib(13)	* Array to hold "date/time group" BCD digits.

DEMONSTRATION PROGRAM

* This program implements a simple, user-friendly data logger.
* It can be used in two ways: If a PC running terminal software [9600 baud, N81, carriage returns (CR) converted to CR plus linefeed, no handshaking] is connected, the program displays a menu and prompt that allows the user to display the ADC readings; view/set the clock, read, dump, or erase memory; or start the logger. If no terminal is connected, or the user doesn't press a key within a preset time, the program automatically starts logging data. It takes samples from both ADC inputs every 60 seconds and records these, along with a time-tag and error-detection checksum, into EEPROM.

* Initial setup.
OUTH = pwrOn
DIRH = \$FF
DIRL = \$FF
* Get ready to turn on peripherals.
* Set all bits of high port to output.
* Set all bits of low port to output.

* setup =====
* When you apply power to the board, the BS2 will send a message at 9600 bps through the built-in serial port asking for setup instructions. If you don't press a key within timeout seconds, the program will begin logging data.

setup:
serout 16,b96,[CR,CR,"BS2 Data Logger"] * Sign-on and choices.
serout 16,b96,[CR,"(A)DC (T)ime (C)lock (R)ead (D)ump (E)rase ~ (L)og",CR,">"]
serin 16,b96,timeout,log,[temp] * Look for instruction.

* If no instruction arrives within timeout milliseconds, then log data, else get choice from setup menu.
temp = temp & \$0DF
IF temp = "A" THEN showADC
IF temp = "T" THEN time

IF temp = "C" THEN clock
IF temp = "R" THEN readDataLog

IF temp = "D" THEN dumpDataLog
IF temp = "E" THEN eraseLog
IF temp = "L" THEN log
goto setup

* Convert to uppercase.
* Show current ADC measurement.
* Show the current time/date.
* Set the clock/calendar.
* Read data w/checksums.
* Read entire EEPROM.
* Write 0s to all EEPROM bytes.
* Start logging.
* Unrecognized entry; try again.

continued

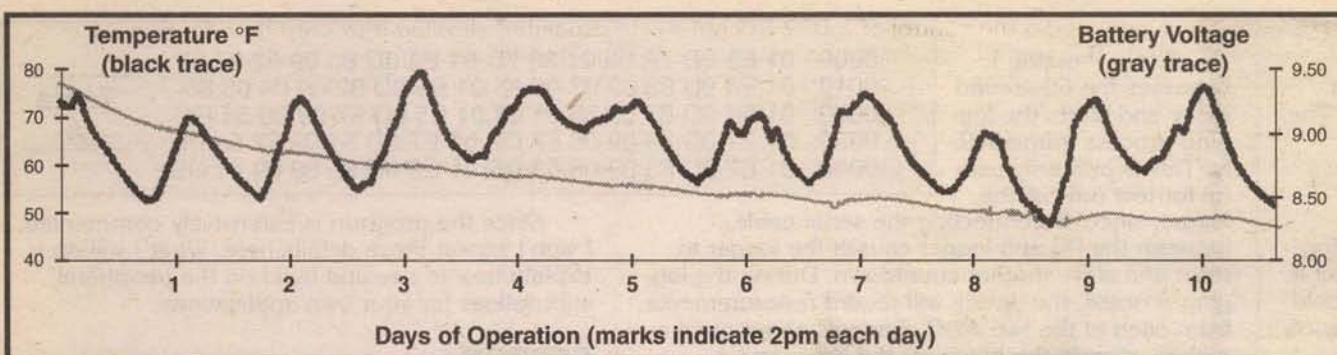


Figure 3. Strip-chart plot of temperature and battery-voltage logged by prototype, made by loading text from logging program into a spreadsheet (MS Excel).

time clock, and precise measurement capability, you have the nucleus of a versatile home-automation system.

For data-acquisition and logging purposes, the BS2 has instructions that simplify sensor interfacing. For example, it can count frequencies to 125 KHz and measure pulses down to 2 μ S, making it a natural for tachometers, humidity sensors, or voltage-to-frequency converters. Got a resistive sensor like a thermistor? Use BS2's RTime instruction to measure it with just a capacitor.

Software Overview

The program listing presents an example application that uses all of the Proto Board's

peripherals to create a data logger. Despite a number of not-absolutely-essential features, the program takes only about two-thirds of the BS2's program memory.

To fully understand the example application, let's look at it from two angles: a user interacting with the data logger; and a programmer studying and modifying the code for his or her own application.

How it Works: User's Perspective

The following discussion assumes that a BS2-IC is plugged into the Proto Board, and that the program from the listing has been downloaded to it.

To use the example data logger, connect the built-in DB9 connector to the serial (com) port of a PC or other computer and boot up terminal software. Set the terminal software for 9600 baud, no parity, eight data bits, one stop bit. Also configure it to always execute a linefeed when a carriage return is received (in ProComm, press ALT-F3).

Connect power to the Proto Board. The following menu/prompt will appear on the screen:

```
BS2 Data Logger
(A)DC (T)ime (C)lock (R)ead (D)ump
(E)rase (L)og
>
```

Typing the first letter of any item executes the corresponding instruction. If you leave power connected for more than 60 seconds without pressing any key, the logger will begin logging data. If you want to prevent that, periodically press any key to restart the logger's internal countdown. Here's a description of each of the menu items:

(A)DC: Press A to view ground-referenced voltage readings (0 to 4095 representing voltages of 0 to 5 volts) from the two channels of the ADC. This is handy for testing sensors or obtaining data for calibration purposes. Data displayed on the terminal screen looks like this:

Ch0: 557

```
* showADC =====
* Take a single-ended measurement from each of the two ADC
* channels and send it out the built-in serial port at 9600 baud. Handy
* for calibrating analog conditioning circuitry.
showADC:
  ADmode = 1          * Single-ended measurement.
  for ADch = 0 to 1    * Both channels, 0 and 1.
    gosub ADread        * Read selected channel.
    serout 16,b96,[CR,"Ch",DEC ADch,": ",DEC ADres] * Display
  result.               * Next channel.
  next
  goto setup
```

```
* time =====
* Put the time and date from the NJU clock chip on the screen and
* go back to the setup routine.
time:
  gosub read_clock      * Update DTG data.
  gosub show_time       * Display the time.
  gosub show_date       * Display the date.
  goto setup            * Back to setup.
```

```
* clock =====
* Let the user set the current time and date via the set_clock sub-
* routine. This code just jury-rigs an IF ... THEN GOSUB ... instruction,
* which PBASIC lacks. When done, goes back to setup.
clock:
  gosub set_clock       * Set the internal clock.
  goto setup            * Return to setup for more instructions.
```

```
* log =====
* Take a single-ended reading from both ADC channels every minute
* and records the data followed by the time and a checksum byte to
* the EEPROM starting at address 0.
```

```
log:
  ADmode = 1          * Set single-ended mode for ADC.
  EEaddr = 0          * Start at address 0.
  EEincr = 1          * Enable auto-increment of
                      * EEPROM address.
```

```
logLoop:
  if EEaddr <= EETop then nextAddr * If EEaddr > EETop,
  EEaddr = 0                    *
  EEaddr = 0                    *
  nextAddr:
  EEcksum = 0                  * Clear the checksum for new data.
```

```
  gosub read_Clock            * Get the current time.
  for ADch = 0 to 1          * Do both channels.
    gosub ADread              * Get ADC result.
    EEdata = ADres.highbyte    * Record the high byte of ADres
                                * word.
```

```
  gosub EEnableAndWrite       * Write the data to EEPROM.
  EEdata = ADres.lowbyte      * Record the low byte of ADres
                                * word.
```

```
  gosub EEnableAndWrite       * Write the data to EEPROM.
  next
  EEdata.highnib = DTG(H10s)   * Record hours.
  EEdata.lownib = DTG(H1s)     *
```

```
  EEdata.highnib = DTG(M10s)   * Record minutes.
  EEdata.lownib = DTG(M1s)     *
  gosub EEnableAndWrite
```

```
  EEdata.highnib = DTG(S10s)   * Record seconds.
  EEdata.lownib = DTG(S1s)     *
  gosub EEnableAndWrite
```

```
  EEdata = EEcksum            * Store the checksum.
  gosub EEnableAndWrite
```

```
* Turn off the peripheral power supply and sleep for approximately
* 60 seconds (according to the BS2's internal timing). The actual
* sleep time will be the nearest multiple of 2.3 seconds (59.8)
* plus or minus about a second for oscillator tolerance.
high Shtdwn
* Turn off peripherals.
```

```
sleep 60
low Shtdwn
goto logLoop
```

```
* dumpDataLog =====
* Dump the entire contents of the EEPROM(s) as hex digits separated
* by spaces. For compatibility with terminal software and convenient
* reckoning of addresses, this loop presents 16 entries on one line.
* This output mode would be handy for recovering data from EEPROM
* in the event a hardware or software problem caused the checksum
* method to fail. It's also useful for debugging new data formats, since
* it lets you look at all the values in the EEPROM.
```

```
dumpDataLog:
  EEaddr = 0          * Start at address 0.
  EEincr = 1          * Autoincrement
                      * EEPROM addresses.
```

```
dumpLoop:
  serout 16,b96,[CR,hex4 EEaddr,": "] * Start line "<addr>: "
  for temp = 1 to 16                * Put 16 entries across
                                      * screen.
    if EEaddr = EEmax then setup      * End of memory: exit.
    gosub EEread                     * Read a byte from
                                      * EEPROM memory.
```

```
  serout 16,b96,[hex2 EEdata," "] * Show "address: <data
  next                             * data...>"
                                      * Do it again.
```

goto dumpLoop

```
* eraseLog =====
* Erase (write 0s) to every address in the combined EEPROM storage
* bank. This process takes several minutes to complete, after which
* the "BS2 Data Logger" prompt reappears on the screen. This is a
* brute-force erase routine, in that it does not take advantage of the
* EEPROM page-write capabilities, or the possibility of writing to the
* two EEPROMs simultaneously. These steps might speed the erasure
* process to a minute or less, but at the expense of extra code.
```

```
eraseLog:
  EEdata = 0: EEincr = 0          * Write 0s; don't incre-
                                      * ment addr.
  for EEaddr = 0 to (EEmax-1)    * Write to all EEPROM
                                      * addresses.
```

```
  gosub EEnableAndWrite
  next
  goto setup                    * Done: back to setup
                                      * menu.
```

```
* readDataLog =====
* Read time-tagged data entries from the EEPROM until an invalid
* checksum, a string of 0s, or the end of memory. Note that the
* string-of-zeros condition will be falsely triggered at midnight,
* January 1, if both ADC readings happen to be zero.
```

```
readDataLog:
  EEaddr = 0          * Start at EEPROM address 0.
  EEincr = 1          * Enable auto-increment of
                      * EEPROM address.
```

```
next_entry:
  EEblank = 1          * Reset 0 flag to test for sequences
  of 0s.
  EEcksum = 0          * Reset checksum to test for data
  validity.
  serout 16,b96,[CR] * Start a new line on the terminal
  screen.
  for ADch = 0 to 1    * Retrieve each of the recorded
  ADC channels.
    gosub EEread        * Read high byte from the
                        * EEPROM.
```

```
  ADres.highbyte = EEdata * Put it into high byte of ADres.
  gosub EEread            * Repeat this for the low byte.
  ADres.lowbyte = EEdata
```

```
  serout 16,b96,[dec ADres,TAB] * Display ADres word in decimal..
  next                          * ..followed by a tab character.
```

```
  gosub EEread            * Now get time digits..
  serout 16,b96,[hex2 EEdata,":"] * ..show "hh:" (hours)
  gosub EEread            *
  serout 16,b96,[hex2 EEdata,":"] * .."mm:" (minutes)
  gosub EEread
```

```
serout 16,b96,[hex2 EEdata] * .."ss" (seconds)
EENoCk = 1                  * Now, get checksum. Turn off read checksum
calculation.
gosub EEread                * And read in the written checksum byte.
if EEdata <> EEcksum then invalid_sum * Verify checksum.
if EEcksum = 0 and EEblank = 1 then invalid_blank * Check for
0s.
if EEaddr > EETop then endOfLog
goto next_entry            * Do the next one.
```

```
invalid_blank:
  serout 16,b96,[CR,"Stopped. End of data.",CR]
  goto setup
```

```
invalid_sum:
  serout 16,b96,[CR,"Stopped. Invalid checksum.",CR]
  goto setup
```

```
endOfLog:
  serout 16,b96,[CR,"Stopped. End of EEPROM.",CR]
  goto setup
```

EEPROM SUBROUTINES

Depending on the address in EEaddr, select either EEPROM 0 (addresses 0-8191) or EEPROM 1 (addresses 8192-16383). Note that this routine activates the selected EEPROM, but leaves it to the calling code to deactivate it. An additional effect of the read and write routines is to add the value of EEdata read or written to a variable called EEcksum. This checksum can serve as a marker to separate valid data from leftover garbage in the EEPROM. It's not infallible, but combined with time/date tagging, it can be very effective.

```
* pickEE =====
* Based on the address in EEaddr and the size of the installed
* EEPROMs, turn on the correct EEPROM's enable line.
```

```
pickEE:
  EEsel = 0          * If EEaddr <= EESize, then
                      * EEsel=0..
  IF EEaddr <= EESize then skip1 * ..Else EEsel = 1.
  EEsel = 1
skip1:
  low (EE_CS0+EEsel) * Activate selected EEPROM.
  return             * Return to caller.
```

```
* EEDisable =====
* Write-protect (disable) the EEPROM.
```

```
EEDisable:
  gosub pickEE
  shiftout DATA_CLK,msbfirst,[WRDI] * Send the disable
  opcode.
  high (EE_CS0+EEsel)                * Deactivate the
                                      * EEPROM.
```

```
* EEnableAndWrite =====
* Check the EEPROM and wait until it's not busy. Then write enable
* the EEPROM, and write the byte stored in EEdata to the address
* stored in EEaddr. Update the checksum byte by adding EEdata to
* the previous contents of EEcksum. Finally, if EEincr = 1,
* increment EEaddr to point to the next EEPROM address.
```

```
EEnableAndWrite:
  gosub Read_stats * Get the status register.
  if EEbusy = 1 then EEnableAndWrite * If busy, check again.
  low (EE_CS0+EEsel) * Activate EEPROM.
  shiftout DATA_CLK,msbfirst,[WREN] * Send the enable
  opcode.
  high (EE_CS0+EEsel) * Deactivate the
                      * EEPROM.
  low (EE_CS0+EEsel) * Activate EEPROM.
```

continued

Ch1: 3463

(T)ime: Press T to view the clock/calendar chip's current reckoning of the time and date. The terminal displays (for example):

11:09:14
01/10/96

(C)lock: If the time/date displayed by the logger's clock is wrong, pressing C lets you correct it. In the example display below, prompts are in bold type, user entries are light. DOW stands for day-of-week, and you may pick any day as number 1. Sunday or Monday are usual choices.

Year (YY): 96
Month (MM): 01
Day (DD): 10
DOW (1-7): 3
Hour (HH): 11
Minute (MM): 10

(R)ead: Pressing R causes the logger to read back data from its EEPROM memory. It will stop when it encounters blank memory; locates a bad checksum indicating the possibility of corrupted data; or reaches the end of the EEPROM. For neatly aligned display on the screen and compatibility with spreadsheets, the entries are separated by tab characters.

```
521 3466 10:11:06
522 3464 10:12:04
522 3461 10:13:03
523 3466 10:14:02
523 3462 10:15:00
524 3466 10:15:59
0 0 00:00:00
```

Stopped. End of data.

(D)ump: If a read operation stops, but you suspect that there may be more valid data in memory, pressing D dumps a hexadecimal (hex) listing of the entire contents of memory. Each line begins with a hex number representing the starting point in memory of that line of data. See Table A.

(E)rase: Pressing E writes 0s to all bytes of the installed EEPROM. This process can take five minutes to complete. When it's over, a new menu/prompt appears on the terminal display.

(L)og: Pressing L bypasses the 60-second delay and starts the logging process immediately. This is primarily useful for test runs of the logger, since disconnecting the serial cable between the PC and logger causes the logger to reset and start another countdown. During the logging process, the device will record measurements from each of the two ADC channels about once a minute, storing the readings, the time, and a checksum into EEPROM memory. The checksum serves as a simple indication of whether or not the data was recorded correctly, like the parity bit in serial communications. Between measurements, the logger goes into battery-saving sleep mode, reducing current draw to less than 1 mA.

Since it takes eight bytes to store the readings, time tag, and checksum, the maximum logger memory of 32 KB will hold 4096 readings; about 68 hours worth at one sample per minute. Its program could be changed to take readings more or less often; store more or less data per reading; record readings only when a significant event occurred; or operate under any rules that you can imagine and write as a PBASIC-2 program.

The whole point of this example application is customization through programming. And that is my unsavory transition to the next section of this article ...

How it Works: Programmer's Perspective

As the schematic in Figure 1 shows, the Proto Board consists primarily of a serial bus supporting four peripheral ICs: the two EEPROMs, clock, and ADC. So it makes sense that the primary job of the program is to drive these devices using the BS2 instructions Shiftout and Shiftin.

The other defining feature is the extensive use of Serin and Serout to interact with the user as described in the section above. The program uses PBASIC's serial formatting capabilities to translate between internal data formats (like the binary-coded decimal array of the clock) and more human-friendly forms.

```
0000: 01 E3 0D 7A 09 01 08 7D 01 E3 0D 83 09 02 07 86
0010: 01 E3 0D 83 09 03 05 85 01 E5 0D 82 09 04 03 85
0020: 01 E4 0D 83 09 05 01 84 01 E5 0D 87 09 05 59 E1
0030: 01 E7 0D 83 09 06 57 DE 01 E7 0D 84 09 07 55 DE
0040: 01 E7 0D 85 09 08 53 DE 01 E8 0D 85 09 09 51 DE
```

Table
A

Since the program is extensively commented, I won't repeat those details here. What I will do is explain how to use and build on the peripheral subroutines for your own applications.

EEPROMs

The EEPROM routines let you write a byte of data to any address within the two-chip EEPROM memory. For example, suppose you have 16 KB of EEPROM (two X25640P chips) installed. You set the address (EEaddr) to 9000 and gosub EEread to read back the data stored at that address. EEread first determines which EEPROM contains the given address. Since 9000 is greater than the highest address available in the lower EEPROM, EEPROM 0, the subroutine pickEE selects EEPROM 1. Another subroutine, send_addr, strips off the bits of the address exceeding 8191 — the largest address in the X25640s — when it sends out the address message to EEPROM 1. So these subroutines cooperate to make two EEPROMs look like one big EEPROM. The address value EEaddr is unaffected by these adjustments. After EEread, EEaddr still contains 9000, but EEdata now contains the byte stored at that location in the combined EEPROM.

In our data-logging example, bytes are written to sequential EEPROM addresses starting at 0 and working upward towards the maximum address of the installed EEPROM. The send_addr subroutine can be instructed to increment (add 1 to) the address after each read or write. This is controlled by the bit EEincr; if it's 1, increment; if 0, don't increment. In the example above, if EEaddr were 9000 and EEincr were 1, after EEread, EEaddr would contain 9001.

The EEPROM routines can also maintain a checksum. What's a checksum? It's a running total of a series of values written to or read from the EEPROM. By comparing the checksum that was written to the checksum calculated when the same bytes were read back, the program can

```
shiftout DATA_CLK,msbfirst,[WriteEE] ' Send write opcode.
gosub Send_addr ' Send the address.
shiftout DATA_CLK,msbfirst,[EEdata] ' Send the data.
high (EE_CS0+EEsel) ' Deactivate the
' EEPROM.
EEcksum = EEcksum + EEdata ' Update checksum.
return ' Return to program.

' EEread =====
' Read data from the EEPROM. Use the address in EEaddr;
' put data into EEdata. Add the value of EEdata into the byte
' EEcksum as an informal check of the validity of a sequence
' of bytes. Setting the bit EEEnck turns off checksum calculation
' for one byte read—usually the checksum itself.
' This code also clears the readZero bit whenever it retrieves
' a non-zero byte. This lets other parts of the program recognize
' unbroken sequences of zeros, which would otherwise pass the
' checksum test.
EEread:
gosub pickEE ' Select the EEPROM.
shiftout DATA_CLK,msbfirst,[ReadEE] ' Send the read opcode.
gosub Send_addr ' Send the address.
shiftin DATA_CLK,msbpre,[EEdata] ' Send the data.
high (EE_CS0+EEsel) ' Deactivate the
' EEPROM.
if EEEnck = 1 then noCkSum ' No cksum if bit=1
EEcksum = EEcksum + EEdata ' Update checksum.

noCkSum:
EEEnck = 0 ' Reset no-check bit
if EEdata = 0 then readZero ' If data=0, don't clear
EEblank.
EEblank = 0
readZero:
return ' Return to program.

' Send_addr =====
' Send the EEPROM address for a read or write and optionally
' increment the address afterwards for writing sequential addresses.
Send_addr:
shiftout DATA_CLK,msbfirst,[EEaddr + EEsize]\16]
EEaddr = EEaddr + EEincr ' Increment address if bit=1.
return ' Return to program.

' Read_stats =====
' Read the EEPROM status register, which contains the write-in-
' progress or "busy" bit. This should be checked before each write to
' ensure that the EEPROM is ready to accept new data.
Read_stats:
gosub pickEE
shiftout DATA_CLK,msbfirst,[RDSR] ' Send read-stats
opcode.
```

```
shiftin DATA_CLK,msbpre,[EEstats] ' Get status.
high (EE_CS0+EEsel) ' Deactivate the
' EEPROM.
return ' Return to program.

=====
NJU6355 CLOCK/CALENDAR SUBROUTINES
=====

' read_clock =====
' Get the current date/time group from the NJU6355 clock and store
' it in the array DTG(n).
read_clock:
low NJU_IO
high NJU_CE
for digit = 0 to 12
shiftin DATA_CLK,lsbpre,[DTG(digit)\4]
next
low NJU_CE
return

' write_clock =====
' Get the time stored in DTG(n) and write it to the NJU6355 clock.
' Note that the NJU6355 does not allow you to write the seconds
' digits. If clears the seconds digits when written, so if you set it for
' 08:30 (hh:mm), when the write is complete, the NJU6355 starts at
' 08:30:00 (hh:mm:ss).
write_clock:
high NJU_IO
high NJU_CE
for digit = 0 to 10
shiftout DATA_CLK,lsbfirst,[DTG(digit)\4]
next
low NJU_CE
return

' set_clock =====
' Set the clock/calendar based on data entered by the user at
' 9600 bps through the built-in serial-port connector.
set_clock:
serout 16,b96,[CR,"Year (YY): "] gosub get2BCD ' Get year.
DTG(Y10s) = temp.highnib:DTG(Y1s) = temp.lownib ' Store.
serout 16,b96,[CR,"Month (MM): "] gosub get2BCD ' Get month.
DTG(M10s) = temp.highnib:DTG(M1s) = temp.lownib ' Store.
serout 16,b96,[CR,"Day (DD): "] gosub get2BCD ' Get day.
DTG(D10s) = temp.highnib:DTG(D1s) = temp.lownib ' Store.
serout 16,b96,[CR,"DOW (1-7): "] ' Get day of
' wk.
serin 16,b96,[HEX1 temp] ' Store.
DTG(day) = temp.lownib
```

```
serout 16,b96,[CR,"Hour (HH): "] gosub get2BCD ' Get year.
DTG(H10s) = temp.highnib:DTG(H1s) = temp.lownib ' Store.
serout 16,b96,[CR,"Minute (MM): "] gosub get2BCD ' Get month.
DTG(M10s) = temp.highnib:DTG(M1s) = temp.lownib ' Store.
gosub write_clock
return

' show_date =====
' Display the date stored in DTG.
show_date:
serout 16,b96,[CR,HEX DTG(Mo10s), HEX DTG(Mo1s),"/",HEX
DTG(D10s), -
- HEX DTG(D1s),"/",HEX DTG(Y10s), HEX DTG(Y1s)]
return

' show_time =====
' Display the time stored in DTG.
show_time:
serout 16,b96,[CR,HEX DTG(H10s), HEX DTG(H1s),":",HEX
DTG(M10s), -
- HEX DTG(M1s),":",HEX DTG(S10s), HEX DTG(S1s)]
return

' get2BCD =====
' Get two BCD digits using the HEX2 modifier. Within the range 0-9,
' hex and BCD are the same, so this is useful for setting the clock
' in its BCD format.
get2BCD:
serin 16,b96,[HEX2 temp]
return

=====
LTC1298 12-BIT ADC SUBROUTINE
=====

' A2read =====
' Configure the ADC for the channel/mode set by the bits of ADcnfg,
' then take an ADC reading, returning the result in the word variable
' ADres. The program should set up the mode bit (ADmode; 1 = single
' ended, 0 = differential) and channel (ADch; 1 = ch1; 0 = ch 0) before
' executing a Gosub to this routine. Note that when the mode is
' differential, the channel selection indicates which channel is
' considered to be the + connection for the measurement.
A2read:
ADcnfg = ADcnfg % 1001 ' Set start bit and msbf.
low ADC_CS ' Activate the ADC.
shiftout DATA_CLK,lsbfirst,[ADcnfg\4] ' Send config bits.
shiftin DATA_CLK,msbpost,[ADres\12] ' Get data bits.
high ADC_CS ' Deactivate the ADC.
return ' Return to program.
```


Table 1. Components of the Data Collection Proto Board

Qty	Designator(s)	Part/Value	Description	Vendor	Vendor PN
2	U2, U3	X25640P	8KB serial EEPROM	S. Edwards Elec.	16KB EEPROM
2	U2, U3	X25128P	16KB serial EEPROM	S. Edwards Elec.	32KB EEPROM
1	U1	LP2950BZ	5-volt regulator	Digi-Key	LP2950BZ-ND
1	U4	NJU6355ED	Clock/calendar	Digi-Key	NJU6355ED-ND
1	U5	LTC1298CN8	12-bit ADC	Digi-Key	LTC1298CN8-ND
1	U6	LP2951ACN	5-volt regulator	Digi-Key	LP2951ACN-ND
1	XTAL	32768 TF XTAL	32.768KHz crystal	Jameco	14584
7	C1-4, C7,10,11	0.1µF	50 WVDC cap	Hosfelt	15-696
2	C8,5	10 µF	10-16 WVDC tant. cap	Digi-Key	P2026-ND
1	C6	0.47F	5.5 WVDC backup cap	Digi-Key	P6951-ND
1	R1	220Ω, 1/8W	5% carbon film resistor	Digi-Key	220EBK-ND
4	R2,3,5,6	1K, 1/8W	5% carbon film resistor	Digi-Key	1KEBK-ND
2	R4,7	10K, 1/8W	5% carbon film resistor	Digi-Key	10KEBK-ND
1	D3	1N34A or 1N270	Germanium diode	Jameco	35941
1	J1	DB9 fem	Right-angle DB9 fem	Jameco	104951
1	J2	1x2 hdr	2-contact male header	Jameco	103341
1	—	DIP24 MP	24-pin DIP socket	Jameco	39351
5	—	DIP8	8-pin DIP socket	Jameco	112205
1	S1	Pushbutton	6mm pushbutton	Digi-Key	P8037S-ND
1	PCB	BS2 DCPB	Printed circuit board	S. Edwards Elec.	BS2 DCPB

nize its sampling with the rollover from one minute to the next; taking a new measurement every minute, on the minute, plus or minus a factor for the nap time between checks of the clock. The sampling won't drift away from the actual clock time.

This technique can be extended to cover other intervals. Want seven minutes between measurements? Create a variable called (for instance) countDown and set it to 7. Whenever the routine detects a change of the minutes digit, subtract 1 from

detect most kinds of errors in the data. If the checksums match, there's an error in the data or checksum itself.

The example program uses a faulty checksum as one of the conditions for ending a read of the data log. There are only two non-automatic aspects of using checksums: (1) The checksum byte, EECsum, must be cleared to 0 before a set of data is read or written. (2) Before reading the checksum byte itself, checksum calculation must be turned off by setting the bit EEnoCk to 1.

Clock

The NJU6355 maintains 24-hour time and calendar information in an array of 13 four-bit digits. As long as its supply voltage is 2 volts or better, it keeps very good time. The memory-backup capacitor (C6) on the Proto Board can keep it running for more than 24 hours (at room temperature; less at extremes of heat and cold). Because of this backup capability, you don't have to rush to change the battery or worry about power failures.

The time/date is stored as binary-coded decimal (BCD) digits. Each digit is represented by a four-bit value. Four bits can represent values from 0 to 15, but BCD uses them only to represent the numbers from 0 to 9. It reserves values greater than 9 for error codes or other purposes.

A side effect of this way of storing a series of digits is that the hexadecimal (hex) numbering system is also based on four bits. Where hex over-

laps BCD, the two are the same; the numbers 0 through 9 hex have the same bit patterns as 0 through 9 BCD. So the example program uses the BS2's hex formatting instructions to read and write the BCD digits of the clock.

Your program can access the digits of the date and time through the array called DTG(). The program includes 13 constants that identify the array entry that contains a particular digit. For instance, the tens digit of the seconds is in DTG(S10s).

This brings up a couple of issues related to time. The program uses the BS2's Sleep function to power down the controller for 60 seconds between samples. Since it records the actual time each sample was taken, the relative inaccuracy of the Sleep interval doesn't matter much.

But suppose you wanted to sample at exact intervals; how would you handle that? Since our units of time don't follow normal math rules (22:25 + 4:40 is not 26:65!), adding the interval to the current time and waiting 'til then involves some awkward programming. A method I like works like this: Suppose you want an interval of one minute. Record the current minute digit in a variable, then enter a loop in which the BS2 naps for, say, 1.3 seconds at a time. When it wakes up, it gets the current time and compares the minutes digit to the stored digit. If it's the same, it goes back to sleep. If it's different, the program takes a measurement. It records the new minute digit, and goes back into the nap loop.

Using this method, the program will synchro-

countDown. If countDown is 0, take a measurement, otherwise go back to the nap loop.

ADC

The ADC is the easiest peripheral to use. There are two settings: mode and channel. To set the mode, you determine whether you want to measure the voltage between one of the channels and ground, or between the two channel inputs. If your measurement will be referenced to ground, you can use the two channels as separate inputs; otherwise you get a single "differential" channel.

The next choice is the channel itself, 0 or 1. For a ground-referenced measurement, this means just what it says — which channel to measure. For a differential measurement, it determines which channel will be considered positive with respect to the other.

Demonstration Run

I thought it would be interesting to use a version of the demo application to gather some data about the Proto Board itself, so I connected the circuit shown in Figure 2.

I didn't have much time before my article deadline, so I modified the program from the listing to sample at 10-minute intervals and took samples for just over 10 days. The board was tucked away in a semi-heated storage/workroom throughout this period. Figure 3 is a graph of ambient temperature and battery voltage versus time generated by loading the data into a Microsoft Excel spreadsheet.

I was gratified to see that there was plenty of life left in the battery after a week and a half, and amused to see some of the events recorded in the data. Between day markers 4 and 5, I forgot to turn off the storeroom's small electric space heater overnight, resulting in the higher-than-normal low-temperature reading. And after a week of operation, I began to wish that I had added some sort of indicator to show that the board was working properly. Just before the day-7 mark, and between days 8 and 9, you can see small jiggles in the supply voltage. These reflect the additional current draw of a loud piezo buzzer that I connected to the peripheral power supply. Each time the logger took a sample, the buzzer would let out a squawk. The additional demand it placed on the supply showed up as small variations in the voltage trace.

Conclusion

The Data Collection Proto Board offers users of the BASIC Stamp II an excellent foundation for designing data loggers and intelligent controllers with data acquisition, storage, and time-stamp capabilities. The circuit and source code presented here show valuable techniques for interfacing with EEPROM memory, a real-time clock, and a precision ADC. **NV**

Sources

Components, kits, and assembled Data Collection Proto Boards are available from Scott Edwards Electronics, 964 Cactus Wren Lane, Sierra Vista, AZ 85635; phone 520-459-4802; fax 520-459-0623; E-Mail 72037.2612@compuserve.com

Note that none of the packages listed below include the BS2-IC, sold by Parallax, Inc. If your application requires storage memory, make sure to order either the 16 KB or 32 KB component packages at the end of the list. If you require large quantities of the Xicor EEPROMs, contact a component distributor like Hamilton Hallmark (800-332-8638) for best pricing and availability.

DCPB Board, bare (no instructions, no disk) \$29.00

DCPB Board, with instructions, disk \$49.00
Complete kit of parts with instructions, disk (0 KB) \$79.00

Assembled with instructions, disk (0 KB) \$119.00

EEPROM memory, 8 KB (one each Xicor X25640P) \$15.00

EEPROM memory, 16 KB (two each Xicor X25640P) \$25.00

EEPROM memory, 32 KB (two each Xicor X25128P) \$45.00

Add \$3.00 for standard shipping and handling; expedited (one- or two-day) shipping available at additional cost. Visa, MasterCard, American Express accepted for phone/fax orders. Personal checks, money orders welcome for orders by mail. Scott Edwards Electronics also offers related products like the serial LCD displays, controller kits, and servo controllers. Contact them for a catalog.

The BS2-IC is available for \$49.00 (at the time of this writing) from Parallax, Inc., 3805 Atherton Road, #102, Rocklin, CA 95765; phone 916-624-8333; fax 916-624-8003; BBS 916-624-7101; E-Mail info@parallaxinc.com

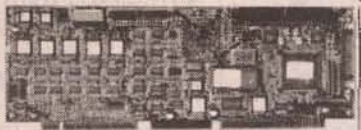
Note that first-time users of the BS2-IC also require a programming package (\$99.00).

Other Vendors

Digi-Key, 701 Brooks Avenue South, P.O. Box 677, Thief River Falls, MN 56701-0677; phone 800-344-4539.

Jameco Electronic Components, 1355 Shoreway Road, Belmont, CA 94002-4100; phone 800-831-4242.

Hosfelt Electronics, Inc., 2700 Sunset Blvd., Steubenville, OH 43952-1158; phone 800-524-6464 or 614-264-6464; fax 800-524-5414.



ADAPTEC SCSI HOST ADAPTER

AHA-2840VL. VL to fast SCSI. No floppy controller on board. New.

96C001 \$99.00 each

SOUND GALAXY Business Audio Board

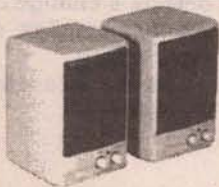
Microsoft Windows Sound System compatible. OPL3 FM stereo synthesizer, 5.5-44.1 KHz sample rate. Dynamic filtering. AT-Bus CD-ROM interface. Includes headphones, drivers and application software.

95C020 \$29.95 each

USED HARD DRIVE

Seagate ST-225, 20MB MFM 5.25" half height.

94C033 \$19.95 each



AMPLIFIED SPEAKER PAIR

These units have excellent audio for their small size (approx. 3" x 3" x 5") and are loud enough, too. A 3.5mm stereo plug brings the audio in, and each speaker has its own volume control. They run on 6VDC (four "C" batteries) or an external 6VDC wall transformer. Cables included.

94V007 \$9.95/pair

MINIATURE FOLDED HORN SPEAKER



8 Ohms impedance. Baffled box for better bass. Frequency response ± 6 dB, 120 Hz to 14 KHz. Use two in parallel for sound enhancement. Applications include multimedia (connects into sound card), ham radio (visor mount), etc. Measures only 3" x 4" x 1". Incredibly good sound for such small speakers!

95V017 \$1.49 each

SURFACE MOUNT TOOL



The Handi-Vac® is used to remove/replace surface mount components. Vacuum to lift the part is generated by the squeeze bulb. Four suction cups complete the ensemble for handling all types of delicate components. Of course, everything is anti-static.

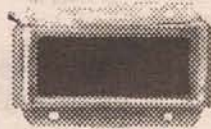
HV-Kit \$9.95 each

PHONE FM TRANSMITTER



This small but powerful circuit attaches to a phone line and transmits the conversation into the FM band. It uses the phone line itself as an antenna. No battery is required since power is drawn from the phone line. Easily adjusted to transmit outside the commercial FM band for greater security. Sold only as a testing device.

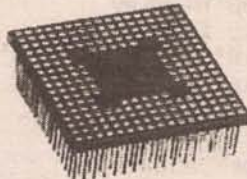
Kit 16 \$12.99 each



LIQUID CRYSTAL SHUTTER/VARIABLE DENSITY FILTER

0.5" x 1.625" active area. 0% to 23% transmission. Switching rate up to 4 KHz. Specs included.

92L012 Only \$9.95 each



228 PIN PGA SOCKETS

• 17x17 wire wrap gold.

96J003 \$9.95 each

• 17x17 solder tail tin.

96J002 \$1.75 each

H-P MICROWAVE DIODES

5082-2351, matched pair.

92S076 \$3.79



HT8950 VOICE MODULATOR IC

On-chip SRAM. Robot function. Vibrato function. 8 KHz sampling rate. Few external components. Seven steps for shifting levels. 8-bit A/D and D/A converters. Single power supply 2.4 to 4.0 V. LED indicator following volume. Pushbutton and electronic mode selection. Construction article on how to build a voice-altering device included.

95I002 \$10.00 each



LASER POINTER

This solid-state laser emits a red light up to 5mW at 670nm that will produce a spot on objects up to 100 ft. away. Use as a pointer/instructional aide, tease your cat, or use as a sight for your peashooter. Buy two so you and a friend can have lightsaber battles on foggy nights. Runs on two AAA cells and comes in a hard, protective case. Batteries included.

94L007 \$49.95 each



AIRPAX STEPPER MOTOR

12 Volt, 36 Ohms, 20 steps/rev., 1.375" dia., 0.125" shaft.

94M005 \$2.50 each

50-LB. CARE PACKAGE

Surplus goodies from Silicon Valley. This is not junk, just material we've acquired in quantities too small to catalog - electronic and mechanical subassemblies for everything from robots to rockets. Assortments may include ICs, caps, connectors, bearings, diodes, hardware, circuit boards, cables. Weird and wonderful stuff. Most folks are happy with the assortments we send and we often get reorders. Try one.

92U034 50 Lbs. for \$49.95



SHAPE-MEMORY LINEAR ACTUATOR

This one inch-pound actuator is made of brass and plastic, and incorporates a helical spring made of the nickel-titanium alloy called Tinel®. This metal enables the actuator to perform a unique set of electromechanical functions. The device provides linear actuation in minimal space, without gears or converters, with nominal one-pound force continuously throughout its stroke. Shape-memory actuation starts and stops gently, minimizing vibration. There are no magnetic materials, and the unit is resistant to corrosion, jams and overloads. Applications include robotics, doors, valves, toys, shutters, security devices, manipulators and many others. The unit may be operated by temperature or electricity. Spec sheets included.

Nominal Specifications: Operating voltage: 1V, 5A. Electrical resistance: 0.2 Ohms. Pull in cycle: 2 sec. Relax cycle: 8 sec. Max. cycle rate: 6 cpm. De-energized length: 100mm. Energized length: 75mm. Diameter: 9mm. Stroke: 20mm. Self-activating temperature: 165°F.

95T001 \$7.95 each

ROBOTICS RELAY

Control circuits up to 2500 Watts with a DC pulse. This 12-30V latching relay will stay in position until it receives a second pulse. Control the unit from a simple SPDT-NO switch or from logic. Ideal for robotics, power control, remote control or controlling a load from several locations. Application notes included.

94B010 \$7.95 each

PRECISION EYEPIECE

21mm f:3.5. Four coated glass lenses in black aluminum case measuring 1.15625" long by 1.0" diameter. Excellent correction of all aberrations for an angle of 35 deg. without vignetting. Resolution in focus is 385 lines/mm when the image of object is in focus (D=6mm), or 500 lines/mm when object is in focus (numerical aperture 1.41). Possible applications include: objective lens for scanners; photographic objective enlarging nearly 10X; objective for a handheld microscope, enlarging from 30X to 120X (numerical aperture=1.41); lens working with light sensor or emitter as a precise focusing element; or lens for shaping a laser beam.

92L031 \$12.50 each



12VDC MINI FAN

60mm (2.375") square.

94F004 \$4.95 each

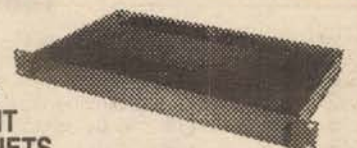


DUKE'S DELIGHT

Five pounds of assorted electronic hardware - fasteners, nuts, bolts, screws, brackets, springs, standoffs, arms, gears, pulleys, and indescribable metal stuff scrounged from Silicon Valley's surplus to complement your hardware hoard.

92Z009 5 Lbs for \$4.95

RACK MOUNT CABINETS



These industry-standard 19" rack mount cabinets are made from 0.04" steel, with the front and rear panels being made from 0.06" aluminum for easier, custom fitting. These cabinets have been finished in gunmetal grey and come flat packed, ready for final assembly. These enclosures have die punched venting. Handles are furnished on all cabinets except RC3120A. These are sturdy, well-made, commercial quality cabinets and are sure to make your project look its best.

RC3120A - Front panel 19" x 1.6875"

1.5"H x 16.625"W x 9.625"D - \$38.00

RC3120B - Front panel 19" x 3.4375"

3.25"H x 16.625"W x 9.625"D - \$46.00

RC3120C - Front panel 19" x 3.4375"

3.25"H x 16.625"W x 13.1875"D - \$53.00

RC3120D - Front panel 19" x 5.1875"

5"H x 16.625"W x 13.1875"D - \$58.00

RC3120E - Front panel 19" x 5.1875"

5"H x 16.625"W x 16.75"D - \$63.00

RC3120H - Front panel 19" x 8.6875"

8.5"H x 16.625"W x 16.75"D - \$83.00



HEAVY DUTY INSTRUMENT CASES

Unit splits apart for ease of access. Self-adhesive feet and screws included. ABS plastic used for flexibility and strength. Grey body complete with black front and rear panels. IC115B includes ventilation slots and speaker recess.

Order #	Price	Dimensions (HxWxD)
IC115A	6.20	2.5" x 8" x 6.4"
IC115B	8.20	3.1" x 10" x 7.4"



JOYSTICKS

Two 150K pots.

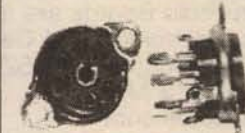
93P005 \$3.95 each



TVRO MOTHERBOARD

Actual part may differ from photo, but these defective units contain many useful parts including a 950-1450 MHz tuner, two NEC 5801 gain blocks, filters, etc.

92A068 \$19.95 each



7-PIN TUBE SOCKETS

96J001 79¢

6 METER FSK BOARD

Crystal controlled on 50.675 receive frequency. Super het with 10.7MHz IF. Three ICs and one transistor. Not a kit! New, with schematics and spec sheet for major components.

92A067 \$9.95 each



ALLTRONICS

2300 Zanker Road - San Jose, CA 95131-1114

(408) 943-9773 - Fax (408) 943-9776

World Wide Web: <http://www.alltronics.com>

On-Line Ordering (408) 943-0622 • 14400-N-8-1-24 Hrs

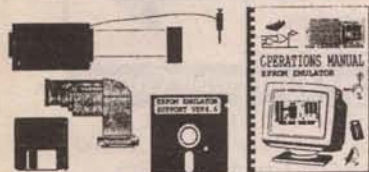
Store Hours: 9-6 M-F & 10-3 Sat. - Pacific
Visa, M/C, AmEx Accepted.
California Residents Add Sales Tax.
Shipping Additional on All Orders.
Prices Good 60 Days from Date of Publication



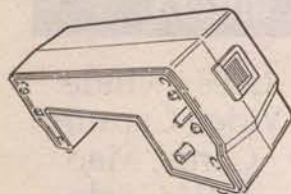
Send \$2.00 For Our Latest Catalog!
\$4.00 Foreign. Refundable on First Order.

010396

BUILD YOUR own IBM compatible computer from parts for as little as \$399 with the help of an easy to view 74 minute video tape that shows you how. This award winning tape will show you how to save money by assembling any compatible 286, 386, 486 or Pentium computer in a step by step easy to follow procedure. It's easy when you know how. Order your video tape today while supplies last for only \$29 (reg. \$59.95) plus \$2.95 P&H. Send check to **EVP, P.O. Box 2201, Northlake, IL 60164-0201** or Call: **1-800-754-5096** Now!



EPROM EMULATORS. Test your code without disconnecting equipment. All ICs mounted in sockets. **MODEL-32** (2764-27256) \$109. **MODEL-64** (2764-27512) \$129. **PRO-SERIES.** Includes battery back-up and real time link for single byte changes. **PRO-128** (2764-27010) only \$199. **PRO-512** (2764-27040) for \$259. \$5 shipping. Visa. Logical Design Tools, Inc. 512-888-4535. Internet: <http://www2.interconnect.net/ldti/hom.htm>



ZENITH LAPTOP BATTERIES. For Zenith SupersPort Laptop Computers. New. 4 Amp hour \$25 each. Quantity discount available. **STC-Surplus Trading Corporation**, Benton Harbor, MI. 616-849-1800, 616-849-2995 FAX. We ship UPS/COD.

COMPUTER SOFTWARE

IBM SHAREWARE free catalog, \$1 disk, 35¢ specials, huge selection, 100% virus free. **PMA, Box 2424, Scottsdale, AZ 85252.** 602-496-6547.

95 FORMAT Utility. This program will format 1.44 meg floppy disks to the new 1.7 meg format used by Microsoft. Allows you to make backup copies of your disks not otherwise possible. This disk is an essential addition to your collection of "must have" utility programs. To obtain your copy, call 1-800-704-6500. Visa, MasterCard, & Discover accepted, or send check or money order for \$7.95 to: **Computers, Etc., 204 Sonderen Street, O'Fallon, MO 63366.**

DATA CONVERSION 9-Track Reel to any format 1600/6250 BPI. \$\$. Best Price Anywhere! \$907-227-4637.

CP/M SOFTWARE also Amstrad PCW software and hardware. 3", 8" and hard sector disks. Disk copying, 400 formats. Send \$2 for catalog, SASE for free flyer. Specify computer. **Elliam Associates, PO Box 2664, Atascadero, CA 93422.** 805-466-8440.

WHERE CAN you learn so much about a useful topic with so little effort? **NV June 1995. ALL ABOUT PUMPS and RUSSELL'S "P11" ANIMATION MACHINE** as reviewed by Fred Blechman in **Nuts & Volts June, 1995.** Call today for more information, 1-800-551-2726. Only \$34.95 + \$4 S&H.

PHOTO SCREEN SAVER SOFTWARE. Create your very own eye catching Windows compatible screen saver. Just install .GIF, .TIF, etc. photos into this shareware program and you, too can create attractive screen saver routines. Supplies on two 3.5 in. floppies for \$9 (S/H included). **SUNCOAST TECHNOLOGIES, PO Box 5835NV, Spring Hill, FL 34606.** Voice/Fax 904-596-7599 V/MC accepted.

ATARI 800/XL/XE, Atari ST, IBM software. Free catalogs! Specify machine. **Lotsa Bytes, 644 E. Clinton Ave., Atwater, CA 95301.** 209-358-1160.

QB Video

1-800-249-3025

BEST PRICES OFFERED UP FRONT
NO PRICE GOUGING ON SINGLE PURCHASE ORDERS

One Piece Replacement

Novavision 5700/5800/5600	\$219.95
Millennium 3 with SA System Decoder	\$144.95
Millennium 3 with 7VPD System Decoder	\$134.95
Timeless with SA System Decoder	\$147.95
Timeless with 7VPD System Decoder	\$137.95

Original Equipment (Fully Activated)

5PD (with new remote)	\$129.95
7VPD (with new remote)	\$169.95
SA-8535 (Covers 8535 - 8580 64 Ch.)	\$154.95
SA-8550 (Covers 8550 - 8580 99 Ch.)	\$159.95
Zenith ST-1***	\$159.95

Converters

CT3000 Centurion	\$63.95
M3 Millennium3	\$64.95
TPI550PC Timeless	\$67.95
3XRD 400/60 Ch.	\$34.95

Descramblers

TVT	\$46.95
TNT	\$50.95
M80	\$60.95
PioIII+	\$61.95

EXTERNAL Test Mode Equipment

RFT (7VPD/BBPD)	\$ 99.95
SA Super	\$109.95
Pio Super	\$109.95

Call For Unbeatable Quantity Pricing!

30 Day Return / 6 Month Warranty On All Products

Write in 210 on Reader Service Card.

ALL PHASE VIDEO SECURITY

Combination EMF / Microwave Tester

- Identifies and measures hazardous electromagnetic fields, microwave energy and extremely low frequency.
- Safely tells if hazardous energy is being emitted

model #EM-204.....42.50

Panasonic 550 MHz Cable Converter

Goes To Channel 99

model #TZPC145-3G.....69.00

OSCILLOSCOPES

B&K 20 MHz Dual Trace

- 1 mV/div sensitivity
- AUTO/NORM triggered sweep operation
- AC, TVH, TVV and line coupling
- Calibrated 19 step time-base with x10 magnifier
- Compact low-profile design

model #2120 2 year warranty.....385.00

model #2125 with delayed sweep.....529.95

Pinhole Camera

- Requires 1/16" opening size
- 1-1/2" x 1-1/2" x 7/8"
- Power 7.5-12VDC n .8 lux
- 3.8mm lens included
- 380 lines resolution
- 12V DC Power Supply 9.95

model #CVC50PH.....139.95

Deluxe 26 pc Service Kit

model #1200 49.95

Call For FREE Catalog & Technical Assistance
Add \$8.95 Shipping/Handling
NYS Add Tax
Visa/MC/Discover/Amex

ALL PHASE VIDEO-SECURITY INC.
WHOLESALE VIDEO WAREHOUSE

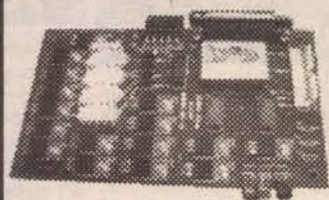
MAIL ORDERS TO:
70 CAIN DR. BRENTWOOD, NY 11717

1-800-945-0909

FAX: 516-435-7494

Write in 55 on Reader Service Card.

STEPPER MOTOR CONTROLLER



ADDRESSABLE STEPPER MOTOR CONTROLLER: JWPIX-1A

\$199.95

NON-ADDRESSABLE STEPPER CONTROLLER KIT: RENIX-1A

\$29.95

Controls up to 4 unipolar stepper motors per controller with 8 digital inputs with a throughput of 500k bytes / sec. Up to 256 Controllers can be stacked on a single parallel port.

Can be used for the following tasks:

- CNC Conversion
- Robotics
- Positioning Platforms
- Telescope Guidance
- Manufacturing
- Animatronics

PARAMAX INC.
1 (800) 473 - 8080

Write in 171 on Reader Service Card.

DIGITAL I/O CONTROLLER

ADDRESSABLE DIGITAL I/O CONTROLLER: JWPIX-3

\$179.95

NON-ADDRESSABLE DIGITAL I/O KIT: RENIX-3

\$29.95

8 Bit Digital I/O controller, 8 buffered digital outputs and 8 buffered digital inputs that function at 500k bytes / second. Up to 256 Controllers can be stacked per parallel port.

Can be used for the following tasks:

- Robotics
- Animatronics
- Servos
- Automated Manufacturing
- Controlling Solenoids
- Digital Prototyping

<http://www.digitalage.com/VM/Paramax>
Paramax products also available through:
FORD Electronics: (714) 521 - 8080

COMPUTER PARTS - SCSI DRIVE ACCESSORIES - SURPLUS ELECTRONICS

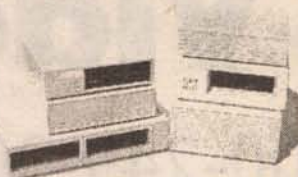
QTY DISCOUNTS AVAILABLE* - GOVERNMENT/EDUCATIONAL PURCHASE ORDERS ACCEPTED - APPLE II / MAC & IBM



Full Size 6 Bay Tower Case

- 200W P/S
 - 6 HH Bays
 - LED's & Rst
 - Fits Fullsize bd.
 - No-tip stands.
- Great for Servers or BBS Use. Lots of room inside. No rails required. Fits any size motherboard.

\$49.00



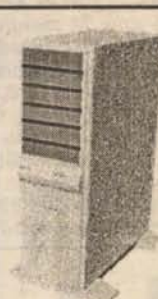
EXT. DRIVE CASES

\$19 - \$65.00

6 HH Bay SCSI Tower Case

- 200W P/S
 - 6 HH Bays
 - 6 ID Selectors
 - No-tip stands.
- All bays Open Face for CD ROM, SyQuest, Optical, Etc.
250 Pin Centronics Connectors & 6 IDC 50 Pin connectors. 6 SCSI ID Selectors.

\$99.00



Power Supplies

Mini Tower Power Supply. 145 Watts. Refurbished.....\$20.00
New.....\$29.00
XT Power Supply. 135W.....\$15.00
XT Power Supply 150W.....\$19.00
IBM XT 65Watt P/S.....\$5.00
AT Power Supply. 200W.....\$29.00
Compaq Prolinea 80W. Standard PC Connectors. +5/12 & -5/12
Great for Small Projects!.....\$19.00

FLOPPY & CD DRIVES

New 360K 5.25" HH Drive.....\$10.00
Used 1.2 Meg 5.25" HH.....\$15.00
NEW 1.2 Meg 5.25" HH.....\$25.00
Used 720K 3.5" Drive.....\$10.00
New 1.44M 3.5" Drive.....\$25.00
CD ROM Drives
2x SCSI External w/Jazz-16\$139.00
2x SCSI Internal w/Jazz-16..\$89.00

External Drive Enclosures • SCSI • CD ROM • Floppy • Computer Cases

External Floppy Drive Case 1 FH/2HH.....\$19.00
SCSI Case: Uses Apple 19 Pin floppy port for power. Quantum EPS type drive only!.....\$19.00
Open Face HH SCSI Case. Use for a SyQuest, Bernoulli, CD-ROM, etc.....\$39.00
"Lunch Box" SCSI Case & P/S 3.5" Only.....\$35.00
Closed Face HH SCSI Case for 5.25/3.5" Drive. 30 Watt P/S.....\$39.00
External MFM/RLL Case & P/S.....\$19.95

FH Close Face SCSI Case & P/S for 1 Full Height 5.25" drive or two HH drives.....\$65.00
External 40 Pin CD ROM Drive case & P/S Includes cntrl'r for Mitsumi/Panasonic.....\$29.00
Desktop XT/AT Case & PS (150W). Reset & Turbo Switch, LED, 2 Exposed HH bays.....\$29.00
Desktop PC Case (No P/S).....\$14.00
Side by Side open face SCSI Case. For two CD ROMs, or 1 CD & HD, or 2 3.5" HD.....\$59.00

Monitors

Open frame composite 9". B&W Monitor assembly. Build your own monitor.....\$19.00

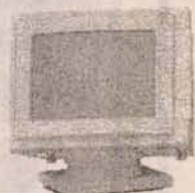
9" B&W Security Monitor. "Box" type with 75 Ω input.....\$59.00

9" Composite "Box" type cabinet. Green screen. Good for security monitor. Input for 75Ω (standard) or High impedance.....\$35.00

Color Composite Monitor. Not suitable for 80 column text but can be used for computer games, Nintendo, as a video monitor. Some have sound input also. Specify.....\$69.00

Used/Refurbished Mono. DB9.....\$29.00

Olivetti 9" Refurb. 9" MonoVGA
with new tube installed. Mono VGA Monitor. Excellent for small places, where color is not needed. Makes a great POS terminal. Use for word processing, accounting and more! Standard VGA 640x480 resolution. Windows looks really good! Excellent Sharp Picture. Very Nice!.....\$99.00



Monthly Specials

Cases • CD ROM Drives • Accessories

MediaVision 16 Bit Stereo Card, Speakers & 2x SCSI CD ROM Combo.....\$89.00
Compaq PS/2 Type Mouse.....\$9.00
Microsoft Works 3.0 w/Money.....\$69.00
PC Pals DOS/Windows (100% Microsoft mode) compatible Trackball. \$14.95
PC Pals Pen Mouse.Same as above.....\$9.95
230 Watt PS/2Power Supply, NEW \$29.00
SIMM Converter 4 30 Pin to 1 72 Pin.\$14.95
SIMM Quadrupler 4 30 Pin in one socket \$29.00
1.44 Floppy Drive (NEW).....\$29.00

FULL COLOR CCD Camera



\$199

Uses include:
Video Capture
Cards, Mac
A/V Cards
Monitoring

NTSC Output • 1/3 inch CCD
FCC Class B • Fixed Focus
330 x 491 Resolution • 75 Ω
6VDC Operation .27A
Approx 4" high. Detachable Base
Great for C-U SeeMe / Internet
use! FULL MOTION COLOR

Alltech Electronics Co

2618 Temple Heights. Oceanside, CA 92056
\$25.00 Min. Purchase for Mail Orders

Phone Orders
619/724-2404

Fax: 619/724-8808
School & Government POs Accepted!
Phone Order Hours 9AM - 5:30PM Mon- Fri

3 Southern California Locations!
Santa Ana - Lomita - Oceanside
1300 E. Edinger. Santa Ana - 714/543-5011
2018 W. Lomita BLVD. Lomita - 310/539-2260
1401 El Camino Real. Oceanside - 619/721-0093
We buy surplus & unwanted computer inventory
as well as scrap electronics related inventory.

Refurbished 286 System

8MHz • 1.2 Floppy
1024 K Ram
Mono Monitor
Keyboard
\$99.00

PC Pals Wireless Headset

20 Foot range, uses AA batteries. Great for late night computer users, kids, etc. Yellow color.

\$19.95



Modem Madness!

Internal 2400 (PC).....\$9.95
Internal 2400 w/NMP1-5.....\$12.95
Internal 9600 v.32/v.42bis.....\$19.95
External 2400 & 96/48 Fax.....\$19.95
External 2400 Hyundai (New).....\$19.95
External 14.4K & Fax.....\$69.00

Fax & Data Modems

EPROMs MICROCONTROLLERS

2716 or 2732.....75¢
2764/27128/27256.....\$1.50
27512, 271000.....\$2.00
8748.....\$2.00
8749.....\$6.00
8751.....\$9.00

CHIPS & ROMs

Intel 486 SX -25.....\$14.95
Intel 486 DX/2 -50.....\$25.00
80287-8.....\$19.00
80387-33.....\$19.00
82450.....\$2.00 8250.....\$1.00

RAM
Short lead 41256 -12 or -15.....50¢
Shortlead 41256 -10.60¢ -08.75¢
41024 -10 (1 Meg x 1) or 44256 -12.....\$2.50 -10.....\$3.00 -80/-70.....\$3.50
256x8 -15 SIMM.....\$3.00 /-12.....\$4.95
256x9 SIP -12.....\$5.95
256x9 SIMM -80.....\$10.00
1 Meg x 9 -10 SIMM.....\$25.00
1 Meg x 9 -80 SIMM.....\$27.00
1 Meg x 9 -70 SIMM.....\$29.00

Batteries

1/2 AA size, 3.6V lithium.....\$6.95
AT type "plug in" 3.6V or 6V.....\$6.95

PC Cards & Accessories

Tandem 286 System (Refurb) w 1024K • Keyboard 1.2 Floppy Drive • Mono Monitor.....\$99.00
9 Pin Serial Mouse.....\$9.00
30 to 72 Pin SIMM Converter (4 30 to 1 72).....\$14.95
Stack 4 30 Pin SIMMs in 1 30 Pin Socket.....\$29.00
CGA/EGA Video Card.....\$19.00
AT MFM HD Only Controller.....\$9.95
AT 2 Meg Mem. Exp Card w/2 Meg.....\$35.00
RAM Sack III AT/386 up to 8 Meg card (OK).....\$19.95
Future Domain 8 bit SCSI Card (NEW/IBM).....\$19.95
5 Pin kybd to PS/2 adapter (Specify direction).....\$2.95
8 Bit VGA Card.....\$17.00
AT Floppy, Serial & Par Controller.....\$9.95
Super I/O IDE, Floppy, 2 Serial, 1 Parallel.....\$14.95
AT MFM HD & Floppy Ctrl.....\$14.95
AT IDE HD Controller.....\$4.95
Mono/Parallel Port.....\$9.95
Full Length CGA w/RCA out.....\$14.95
Microsoft InPort Mouse Card (only).....\$9.00
32 Bit Mem Exp. (9 Meg/OK) SiliconValley.....\$20.00
101 XT/AT Keyboard.....\$29.00
101 AT Keyboard (NEW).....\$14.95
Slot Expanders (3,4 or 5 Slot, for slim type PC cases) Installs in single slot and rises vertically.....\$9.95
AT Motherboard w/1024K.....\$29.95

Laptop Carry Case 12" x 15" x 2.75"

\$19.95

Zippered Exterior pocket 12" x 12" x 1". Carry handles & Shoulder Strap. Greyish color. Originally for Mitsubishi.



UPS Savings!

Un-interruptable Power Supplies!
250 Watt SafePower UPS.....\$59
640 Watt Deltec Refurb.....\$99
Save your Valuable Data and equipment from evil blackouts with a UPS /Power Conditioner.

* QUALITY COMPUTER COMPONENTS *

CALL : **GARY**FOR QUOTE!

WE STOCK IT ALL... CPUs, MEMORY, COMPLETE & BAREBONES SYSTEMS

*****RAM*****

1 MEG 30 PIN \$ 26.00

4 MEG 30 PIN \$ 99.00

4 MEG 72 PIN \$ 89.00

8 MEG 72 PIN \$179.00

OUR LOSS YOUR GAIN

9600 INTERNAL FAX MODEM \$ 8.00

250 MB EXTERNAL TAPE B/U \$80.00

4X CD ROM DRIVE IDE \$89.00

30 TO 72 PIN CONVERTER \$13.00

ProX-Prema 114 KEY "ON SCREEN" PROG

KEYBOARD \$ 39.00 (W/W IN 95 KEYS)

HARD DRIVES

540 MEG \$169.00

1 GIG \$210.00

1.2 GIG IDE \$232.00

1.6 GIG IDE \$269.00

TOP SECRET

CALL FOR YOUR CONFIDENTIAL QUOTE

BWC COMPANY, INC

PHONE: (803) 764-0474

FAX: (803) 824-0278

DEALERS WELCOME...TERMS AVAILABLE...ASK FOR FREE PRICE LIST

Write in 132 on Reader Service Card.

COMPUTER SOFTWARE cont.

YOUR ONE stop multimedia center! New/Used CD-ROMs/PC software; training videos, at the lowest prices! Send large SASE + 96 cents postage for catalog. Using GFA PC BASIC? Join our GBUGPC users group! Rascom, 20220 South Avalon Blvd., #151, Carson, CA 90746.

FREE SOFTWARE CATALOG 1500+ programs: DOS, Windows, Windows '95. Latest releases in all categories: games, business, educational utilities and others. Call 914-295-9166 or write: Shareware Shoppe, PO Box 454, Ferndale, NY 12734.

FIX ANY PC Fast! Use DiagTech Software to test all major hardware components in your system. With DiagPost ROMs Fix Dead PCs. All tests are displayed on your video screen. H. Ross Designs, 408-374-4518, POB 110233, Campbell, CA 95011-0233.

COMMODORE 64 ham programs, 8 disk sides, over 200 ham programs, \$16.95. 32¢ stamp gets unusual software catalog of utilities, games, and British disks. Home-Spun Software, Box 1064-H, Estero, FL 33928.

ENGINEERING SHAREWARE. Printed circuit design, logic simulation, pspice, autocad shareware. Over 700 engineering programs. Free catalog. CD-ROM available. Sector Systems Company, 416 Ocean Avenue, Marblehead, MA 01945. 617-639-2625.

LATEST SHAREWARE. Hard to find technical and related. Cross-assemblers, emulators, semiconductor databases, electronics, PCB design, ham radio, more! DOS/Windows. 89¢ per program. Catalog, \$1 on 1.44 MB or 1.2 MB disk. Charles Santos, PO Box 14111, Arlington, TX 76094-1111.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Now selling memory. We can beat any printed price in Nuts & Volts. Call 1-800-4-MEMORY now! Voice/FAX.

CYCLE ANALYSIS finds patterns in scientific, financial data. Performs Fourier analysis plus data extrapolation, filtering, congruency, more. For IBM order Cycle Analyst \$19.50, or Stock Cyclist \$22.50 (does above plus strategy, pattern analysis). Rotch Design, POB 165, Washington, ME 04574.

I/O CARD Guide. Lost the docs for your I/O card? Don't try to guess at all those jumper settings. Our disk provides a collection of information about most generic I/O cards & controllers. Allows you to print card diagrams as well. If you work on PCs, this is a "must have." To order yours, call Computers, Etc. at 1-800-704-6500. Visa, MasterCard, & Discover accepted, or send check or money order for \$7.95 to: Computers, Etc., 204 Sonderen Street, O'Fallon, MO 63366.

FREE HACKING/phreaking diskette catalogue. Peregrine Dynamics, 720 Portage Trail, Cuyahoga Falls, OH 44221-3035.

LOOKING FOR any software for TI portable professional computer. Have DOS 2.11 512K RAM. Willing to pay for disk and copying fee. Write: Brett Hoff, 114 Griffin Rd., Ochlocknee, GA 31773.

DMV '96 Department of Motor Vehicles databases on CD-ROM. Oregon \$219, Texas \$495, Florida \$495. Call 503-325-0861, Mike.

PCB & CAD SOFTWARE. Symbol Libraries, AutoCad Utilities. New & refurbished computers and components. BAE-Firelands Computers, 1-800-636-7047.

FREE DISK CATALOG and discount coupon! Inexpensive, quality, IBM shareware and CD-ROMs. <ASP> vendor: **MOM 'N' POP'S SOFTWARE**, PO Box 15003-N, Springhill, FL 34609-0111. 352-688-9108.

SHAREWARE CATALOG. Over 3,000 programs, free game on every catalog disk. Great prices, bonuses, free disks. Data Mate, Box 2811, Ronkonkoma, NY 11779.

ELECTRONICS SHAREWARE programs, Yagi design, circuit drawing loaded dipole design, scanner database, bearing/distance calculator, QSL label program, eight programs on one disk. Send \$5 for shipping/handling to Richard Jewell, PO Box 6397, Beauty, KY 41203-6397.



AmBiz Productivity Pak for Windows

USER FRIENDLY customer invoice and distributor order processing for Amway Product Distributors using the latest prices. Five integrated modules that speed up your paperwork. Based on a proven DOS program in use since 1982. 90-day money back guarantee. For Windows 3.1 or Windows '95. \$44.95 postpaid. Cont. US only. SigmaTech Software, 8617 Crescent Beach Rd., Sand Point, MI 48755-9755. 517-856-2653 9-5 EST.

PCB DESIGN software: Do you need to design printed circuit boards, but don't want to spend a lot of money on a CAD package? Do you have Auto-CAD? Then ACAD-GBR is what you've been waiting for! ACAD-GBR takes your Auto-CAD databases and makes Gerber code, for film artwork. For \$49.95 you get the translator, symbol library, Menu for PCB design, and the Drill file generator. For more information call 810-997-1378 x6100. Send check/money order to JJ Design Service, 2070 Jonathon Circle, Utica, MI 48317. Michigan residents add 6.5% tax.

WANTED: INEXPENSIVE drawing software for the Atari 1040ST. I'd like it to draw lines from equations. Also interested in Dyna Cadd if an inexpensive copy is available. Greg Moran, 7540 Orchard St., Apt. 50, Riverside, CA 92504. 909-354-5273 nights.

SOUTHERN ELECTRONICS

954-723-0557

WE WILL BEAT ANY PRICE ON
STEALTH
DESCRAMBLERS
P80 & 1000P

CALL FOR YOUR PRICES!!!
(MINIMUM ORDER 10 PC)

CHECK OUT OUR PRICES ON
BOSS I & II

10 20 50
\$225 \$210 \$190

LET US HELP YOU REDUCE YOUR
INVENTORY COSTS.

NO FL SALES

Southern Electronics

10097 Cleary Blvd., #285
Plantation, FL 33324

Write in 54 on Reader Service Card.

WE SELL **LASERS** FOR:

- ✱ Experiments
- ✱ Laser Light Shows
- ✱ Cutting

We also carry
books and plans
about LASERS.

Hundreds of various LASERS to choose from!
Make hundreds of extra dollars per month performing LASER light shows part-time!

WANTED: SURPLUS LASERS, LASER RELATED EQUIPMENT AND OPTICAL EQUIPMENT!









1269 W. Pomona, Corona, California 91720

CALL FOR FREE CATALOG!
TEL (909) 278-0563
FAX (909) 278-4887

See our catalog on the internet.
[HTTP://WWW.PWEB.COM/MWK/MAIN.HTM](http://WWW.PWEB.COM/MWK/MAIN.HTM)
EMAIL: MKENNY1989@AOL.COM

King of Combos Panasonic TCPC175DG2

-  Volume Control
-  Sleep Timer
-  Last Channel Recall
-  Favorite Channel Memory
-  Parental Lockout
-  STD/HRC/IRC Switchable
-  Channel 2/3 Switchable
-  Infrared Remote Control







Model SP+ **\$239**
A 100% replacement for all Pioneer, all Scientific Atlanta (except baseband), Oak, Hamlin, and Eagle Systems

Model T **\$239**
Perfect for all TOC xx03/07/08 systems including wireless

Model Z **\$239**
The one for all Zenith and Zenith/Oak systems.





G7 Combo

-  Last Channel Recall
-  Favorite Channel Memory
-  STD/HRC/IRC Switchable
-  Infrared Remote Control



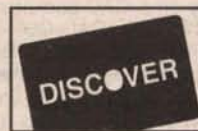
Timeless Products TPI550PC w/G7 **\$139**
Timeless Products TPI550PC with all new G7 Tri-Mode decoder installed. This brand new one piece system is a real crowd pleaser. Easy to install and operate.

SSA-TV86

-  Last Channel Recall
-  Parental Lockout
-  STD/HRC Switchable
-  Infrared Remote Control
- Manual Fine Tuning



SSA-TV86 **\$149**
This updated SSA-TV86 replaces all SA8500-8580 and PIO 5xxx-61xx.

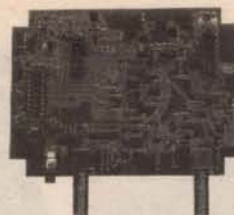


1-800-338-0400

6325-9 FALLS OF THE NEUSE ROAD, RALEIGH, NC 27615

Decoders

	QTY 10	QTY 20
STEALTH 1000-P 5 x 4 Plastic Case w/Toggle	\$49	\$45
TNT 6 x 9 Metal Case w/Toggle	\$45	\$42
TVT-3G 6 x 9 Metal Case	\$42	\$39
MINI-TVT 3 x 6 Metal Case	\$42	\$39
GOLD 3 x 6 Plastic Case	\$42	\$39
APOLLO-J 3 x 6 Metal Case Replaces Purple & SIP	\$49	\$45
FTB-3 6 x 9 Metal Case	\$43	\$39
G7 4 x 4 Board Only	\$39	\$35



	QTY 10	QTY 20
PIO-6300 6 x 9 Metal Case w/Toggle	\$69	\$59
PIO+/TNT 6 x 9 Metal Case w/Toggle	\$69	\$59
PIO RED 3 x 6 Metal Case Replaces Green & Apollo-P	\$69	\$59
STEALTH 80-P 5 x 4 Plastic Case w/Toggle	\$55	\$49
M-80 6 x 9 Metal Case w/Toggle	\$65	\$59
S-BLUE	\$65	\$59

Converters

	QTY 10	QTY 20
--	-----------	-----------

- Stargate Elite**
- Last Channel Recall
 - Favorite Channel Memory
 - Parental Lockout
 - STD/HRC Switchable
 - Infrared Remote



	QTY 10	QTY 20
--	-----------	-----------

- Stargate 550XL**
- Volume Control
 - Sleep Timer
 - Last Channel Recall
 - Favorite Channel Memory
 - STD/HRC Switchable
 - Channel 2/3 Switchable
 - Infrared Remote Control



	QTY 10	QTY 20
--	-----------	-----------

- Panasonic TZPC1453G2**
- Sleep Timer
 - Last Channel Recall
 - Favorite Channel Memory
 - Parental Lockout
 - STD/HRC Switchable
 - Infrared Remote Control



	QTY 10	QTY 20
--	-----------	-----------

- TPI 550**
- Last Channel Recall
 - Favorite Channel Memory
 - Parental Lockout
 - Infrared Remote Control



	QTY 10	QTY 20
--	-----------	-----------

- Centurion**
- Sleep Timer
 - Last Channel Recall
 - Favorite Channel Memory
 - STD/HRC Switchable
 - Infrared Remote Control
 - 100 Channel Capability
 - Fine Tuning



	QTY 10	QTY 20
--	-----------	-----------

- Millennium³**
- Sleep Timer
 - Last Channel Recall
 - Favorite Channel Memory
 - Parental Lockout
 - STD/HRC Switchable
 - Infrared Remote Control
 - 100 Channel Capability



Build your own one piece combo unit. This converter is perfect for installing a descrambler into. No soldering required, all cable included.

THE ULTIMATE PROMISE

1. COURTEOUS AND PROFESSIONAL SERVICE.
2. QUALITY PRODUCTS.
3. LOW PRICES.
4. PROMPT DELIVERY.
5. SATISFACTION GUARANTEED OR YOUR MONEY BACK!



All prices are for 10 pieces, subject to change without notice. Some quantities may be limited. 30-Day Money Back Guarantee. One year parts and labor warranty.

MON-FRI 10-7 EST
SAT 10-3 EST
FAX 1-800-854-7118

ULTIMATE CABLE

THE LASER

EXPERIMENTER

Conducted by
Anthony Charlton

Welcome! In the past, many amateurs have built homemade lasers. This era was one of equal parts exploration, engineering, problem solving, parts procurement — and frustration. Many amateurs built lasers in their basements or other workplaces for various reasons — holography, for example, or for use as measurement and research tools. There was a day of a fledgling technology with all the usual problems associated with technological emergence.

Nowadays, those who lived during this era are amazed that one can go out and buy a basic He-Ne laser powerful enough for most amateur experiments for just \$50.00. Then make a case for it, connect it up to a battery, and have the beam come on instantly and stay on for time periods now measured in years. With no muss or fuss.

In the old days, He-Ne lasers were extremely prone to problems such as gas mixture contamination, impurities annoyingly donated by the vacuum pump (which had to run continuously during laser operation), rapid electrode degradation, and so forth. Nevertheless, it was a fascinating era and a good part of the history of lasers.

Lasers have now become so commonplace and technologically advanced that the comparison is akin to setting the Space Shuttle aside primitive solid fuel rockets used to loft fireworks. Still, we thought you'd like to continue peeking into history for a column or two more, and look at amateur-built projects from the past.

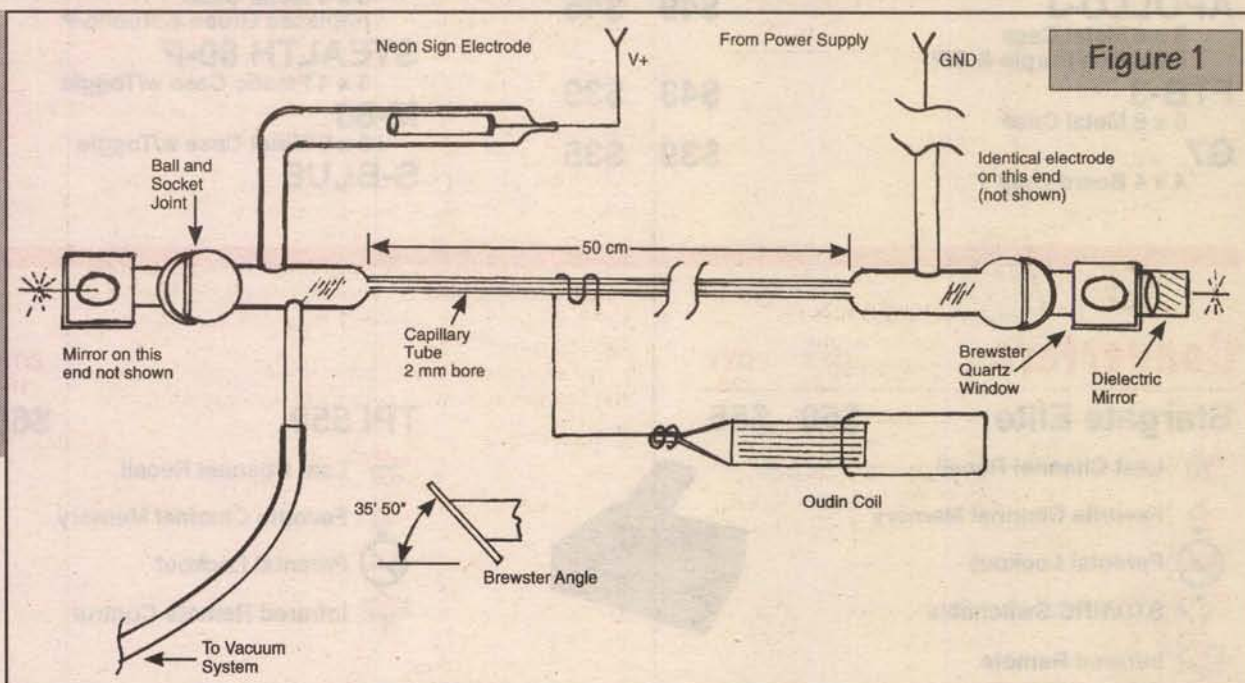
Like with last month's column, the output of the laser we'll cover this month is too powerful, and its power supply too dangerous, to present specific construction details. Should some people undertake building it, it might conceivably lead to someone's personal injury, and no one wants that. And this laser also requires good glassblowing skills — a craft one doesn't pick up overnight. Nevertheless, some amateurs were (and still are) willing to educate themselves with the required skills to accomplish their dreams — whatever they may be. Read on if you would like to learn about the trials and successes of one homemade argon laser.

Pulsed Argon Laser

The argon laser, in this example, is made largely of Pyrex glass construction. Figure 1 shows a sketch of the apparatus. Quartz windows cover both output ends of the plasma tube, and quartz is used because of its low coefficient of thermal expansion and high degree of transparency to the wavelengths of light outputted by this kind of laser. The output ends are cut at the Brewster angle so that the output of the laser is polarized.

Argon lasers are "multi-line," in other words, several wavelengths are generated simultaneously. Commercial argon lasers use different methods to select the wavelength desired; the most common I understand being a DIFFRACTION GRATING — a glass plate precisely ruled with many thousands of grooves per inch. The beam is refracted according to the angle of incidence, and the desired wavelength selected in this manner. Note the beam from this laser exits from both ends. Usually, the beam exits from one end of a laser only. I imagine the output could be intensified in one direction by using a fully reflective mirror, as with other lasers.

To energize this particular laser, a current source of about 2,000 volts is used. The circuit is sketched in Figure



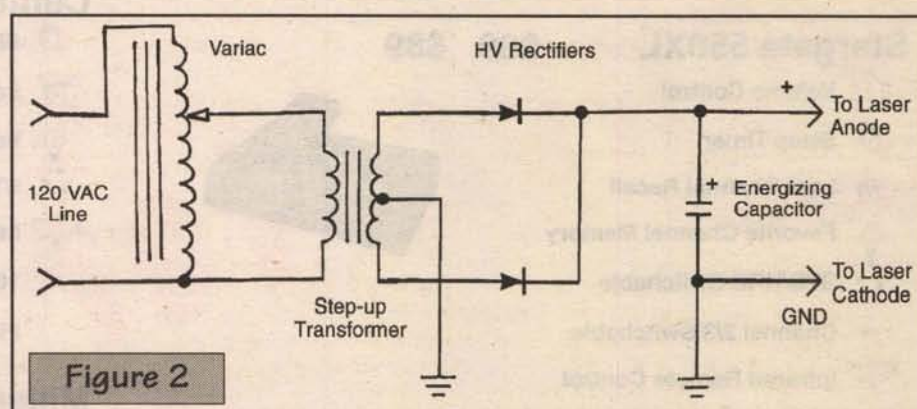
2. A variac controls the voltage to the primary of a neon sign transformer. Two HV rectifiers convert the AC output from that transformer to pulsed DC, which is stored in the energizing capacitor. Referring back to Figure 1, note the Oudin coil attached to the capillary of the laser tube. This ionizes the argon gas within, and allows it to conduct at the rate of 120 pulses per second. As the capacitor charges, it eventually reaches a potential sufficient to fire the laser. A pulse of 15 to 20 amperes at roughly 2,000 volts (we told you this supply was dangerous!) courses through the gas, causing it to become sufficiently pumped to lase.

Although the current discharge occurs in just a few microseconds, the output beam persists for 50 microseconds or so, and at a 120 Hz rate, the beam appears continuous to the eye. Should the laser be operated on a current-continuous basis, the whole assembly would melt in short order.

Commercial argon lasers used to be entirely water cooled, but new advances in design technology have permitted air cooling. However, the heatsink fins are huge and the systems still require forced air cooling.

Commercial argon lasers are a lot less awkward than their amateur brethren. But they aren't cheap either, being on the order of several thousand dollars for a unit whose output is measured in watts. Now they are all self-encapsulated with just a gas reservoir required, in some cases, to restore depleted argon. Only the power supply is distinctly separate from the laser, and this is usually within the laser's enclosure cabinet. Contrast this with the amateur laser which requires:

- 1) A roughing pump.
- 2) A diffusion pump.
- 3) A cold trap to get that annoying pump contamination from getting mixed in with the lasing gas.
- 4) The required gas reservoir (and ultra-pure argon gas).
- 5) A manometer and a vacuum gauge, both of which are used to monitor the argon gas pressure as the laser is



operated.

6) The home-built laser plasma tube which is a definite engineering challenge.

7) And, of course, the power supply.

Whew! All this adds up to lots of money and time, and we surely can salute those who have the persistence (plus skills and resources) to build a working argon laser.

The attraction of the argon laser is due to not only its useful multi-line output, but the high power levels that can be achieved. Both are valuable for research and medical procedures. And who can forget those wonderful computer-animated laser light shows which use the argon laser at the pinnacle of its aesthetic grandeur?

Homemade Capacitor Fabrication for Amateur Lasers

Legend has it that workable capacitors require advanced techniques and fabrication facilities. This is not so! At least not for many of our amateur projects. I thought I'd share with you info for making YOUR OWN capacitors, if you have a laser system(s) which requires

DANGER

HIGH VOLTAGE

Figure 3

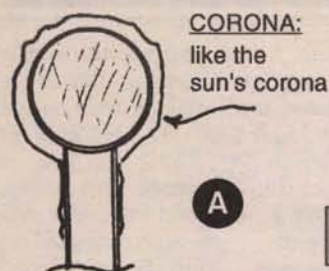
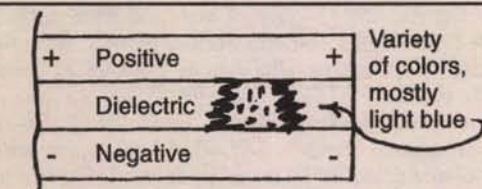
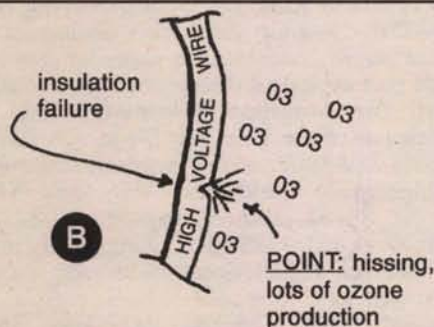


Figure 4



DIELECTRIC ARC: Bang, snap, or pop, usually followed by sizzling & burnt dielectric

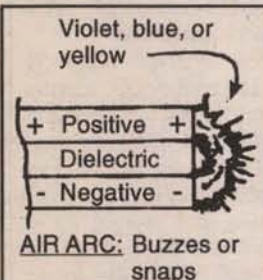


Figure 5

them or if you are a HV experimenter.

Although one cannot vouch for the integrity of homemade capacitors for extended MTBF [1], people have been instrumental in giving out some advice to Tesla coil builders and HV experimenters over the years, who have combined different sources of knowledge to successfully make capacitors. Homemade capacitors have been known

to withstand 20,000 VAC-plus at high frequencies for extended lengths of time without failing.

So in other words, it works. Such capacitors are used in nitrogen lasers, small argon lasers, pulsed single heterostructure infrared lasers, in the copper vapor laser described in the last column, and with other types of lasers. Practical considerations limit the amount of capacity of these home-lab built devices, so we can't reasonably expect to build huge electrolytic capacitors or similar types. Such mammoth components are used for energizing ruby lasers and the like.

Expect about 0.1 uF (100 nanoFarads or 100,000 picoFarads) to be the largest practical size. Yet you can build them for high voltages like 10 KV, 20 KV, or even 100 KV using the following techniques. So limited storage

capacity if the application requires it is not a short-coming if you examine the price of some commercial products vs. your own efforts.

Capacitor 101

First, one has to decide whether the capacitor is to be oil immersed or dry. One advantage of oil immersion is it multiplies the capacity by a property called DIELECTRIC CONSTANT.

Most of us have heard of this term, and to refresh the memory, let's imagine a capacitor whose plates are separated by an air gap, and one whose plates are of equal size and spacing but immersed in mineral oil.

Mineral oil? Oh yes! This pharmaceutical product is used for more reasons than to settle upset human digestive systems. It is very refined, containing few impurities, as it's approved for human consumption. It is also an excellent insulator. Plus, it's much easier to get a hold of than commercial transformer/capacitor oil.

Let's take a look at Equation 1 which describes the formula of how to determine capacity on paper:

$$\text{Equation 1} \\ C = 0.224 \frac{K \cdot A}{d} \cdot [n-1]$$

Where: C = Capacitance in picoFarads (pF)

K = Dielectric constant of insulator

A = Area of one side of one plate in square inches

d = Separation of plates in inches

n = Number of plates

Go ahead and work out an imaginary capacitor on your calculator. Let's just say it's 1,000 pF (0.001 uF) for the moment. Now, by separating the plates with window glass [2], you'd increase its capacity to 7,800 pF, although glass is not recommended, explained in the footnote. Next, refer to Chart 1.

Chart 1
Dielectric (K) Constants

Air = 1.0
Paper (bond) = 3.0
Polystyrene = 2.6
Plexiglas = 2.8
Polyethylene Terphthalate (Mylar) = 3.0
Pharmaceutical Mineral Oil (Squibb) = 2.7
Ordinary Window Glass = 7.8
Polycarbonate (Lexan) = 2.96
Epoxy Circuit Board = 5.2
PVC (rigid type) = 2.95
Polyethylene = 2.3
Teflon = 2.1
Pyrex = 4.8
Silicone RTV = 3.6
Nylon = 3.2
Shellac = 3.3

Measurements are made at 1 MHz. Where several values of dielectric K constant are given, the lowest value was chosen.

Notice mineral oil has a dielectric constant of 2.7. This data was gathered by measurements using a technician-grade Heathkit multimeter. It may be off by a tenth of a decimal place or so, relative to high-cost lab equipment, but the data is fine for our general use. Mineral oil would increase our capacity to 2,700 pF.

Actual measurements of homemade capacitors come in about $\pm 20\%$ of calculated, if your assembly techniques are careful. Not bad! That particular dielectric (among certain others) has the advantage of being "self-healing." That's a term applied to dielectrics that have the capacity to recover partially or totally from transient overvoltages applied to them.

Another crucial parameter is the PUNCTURE VOLTAGE of a dielectric. To be conservative, this should be given a 2x margin over what is expected. So, if 1 mil (0.001 inch) Lexan is used for a capacitor expected to be subjected to 400 volts DC, then opt for using 2 mil Lexan.

Peak voltage, kilovolts	Diameter of spherical electrodes, cm				Needle points
	2.5	5	10	25	
	Length of spark gap, cm				
5	0.13	0.15	0.15	0.16	0.42
10	0.27	0.29	0.30	0.32	0.85
15	0.42	0.44	0.46	0.48	1.30
20	0.58	0.60	0.62	0.64	1.75
25	0.76	0.77	0.78	0.81	2.20
30	0.95	0.94	0.95	0.98	2.69
35	1.17	1.12	1.12	1.15	3.20
40	1.41	1.30	1.29	1.32	3.81

Figure 6

Peak voltage, kilovolts	Diameter of spherical electrodes, cm				Needle points
	2.5	5	10	25	
	Length of spark gap, cm				
45	1.68	1.50	1.47	1.49	4.49
50	2.00	1.71	1.65	1.66	5.20
60	2.82	2.17	2.02	2.01	6.81
70	4.05	2.68	2.42	2.37	8.81
80		3.26	2.84	2.74	11.1
90		3.94	3.28	3.11	13.3
100		4.77	3.75	3.49	15.5
110		5.79	4.25	3.88	17.7
120		7.07	4.78	4.28	19.8
130			5.35	4.69	22.0
140			5.97	5.10	24.1
150			6.64	5.52	26.1
160			7.37	5.95	28.1
170			8.16	6.39	30.1
180			9.03	6.84	32.0
190			10.0	7.30	33.9
200			11.1	7.76	35.7
210			12.3	8.24	37.6
220			13.7	8.73	39.5
230			15.3	9.24	41.4
240				9.76	43.3
250				10.3	45.2
300				13.3	54.7

Figure 7

CORRECTIONS FOR TEMPERATURE AND PRESSURE

Values found in the above table may be corrected for temperature and pressure by multiplying the values given by the appropriate correction factor found below:

Temp. °C.	Pressure mm			
	720	740	760	780
0	1.04	1.06	1.09	1.12
10	1.00	1.02	1.05	1.08
20	0.96	0.99	1.02	1.04
30	0.93	0.96	0.98	1.01

Figure 8

Here we have to closely examine the type of voltage the capacitor has to stand up to. A smooth DC voltage is one thing, and AC voltage or a DC voltage with a parasitic AC component is another. The peak DC voltage rectified from an AC transformer type power supply will be 1.41 times the sinewave RMS measurement [3], aside

Laser Helpline

This is a free service to the readers of The Laser Experimenter who wish to get in touch with one another by whichever medium they mutually prefer. To place your "free ad" (no commercial products, please), send your abstract and communication protocol to: The Laser Experimenter, Laser Helpline, P.O. Box 74, Cornwall Bridge, CT 06754.

Although not related to lasers, reader's responses to the request for information about how to locate the out-of-print book *Build-It-Yourself Science Laboratory* have been extremely helpful. I would like to sincerely thank John M. Grosvenor of Sylvania, OH; John Harrell of Salina, KS; A. Paradis of Akron, OH; and J. Wisnia of Winchester, MA for all their considerate efforts providing valuable information and library book lending data. The object in finding this book is for its resource of innovative ideas. They can now be adapted using modern technology. The plan is to write a book for the young and intermediate student and experimenter who are excited to learn about and experiment with science in many forms, including lasers, and the *Build-It* book is one a person can justifiably call a classic resource for its day and targeted audience.

1. MTBF= (M)ean (T)ime (B)etween (F)ailures.

2. I am deliberately drawing your attention to window glass because it is a rotten choice for a dielectric! When compared to modern, highly-purified plastics, it can't hold a candle. Glass was the dielectric choice of amateurs for the past, but since its slightly green tint (look edgewise into a pane to see this) is due to iron impurities, its MTBF is often. These impurities manifest themselves in spots where high voltage can break through. For example: I once hooked a 15 KVAC neon sign transformer to a window glass capacitor, only to have it fail with a resounding mini-explosion that cracked several panes, and bored a hole through two of them! It SHOULD have held up, according to calculations. Refined glass is used in commercial capacitors with few of the problems that common window glass presents.

3. RMS= (R)oot (M)ean (S)quare.

4. Expressed in "Length of spark gap, cm" where one cm (centimeter) is roughly 0.394 inches.

from any possible voltage spikes present.

Figure 3 shows the primary consideration above failure, and even though it's a bit melodramatic, several copies of this label should be attached to any HV project. Photocopiers can enlarge this label to any size, so it's recognizable even by children, should they become curious about your capacitor project and need to get warned off.

Figure 4 shows common sources of failure from capacitors. Figure 4A is CORONA DISCHARGE, a leakage of electricity directly into the air from uninsulated surfaces at high voltages. The cure for this is to insulate the affected surfaces with products like Corona Dope or High-Voltage Putty. These sundries can be purchased from dealers who cater to the TV industry.

Products like these, and similar ones, are used to insulate the TV's HV components like capacitors, fly-backs, and PC boards. Figure 4B shows the leakage from a cracked or aged HV wire. Replacement of the wire is required in general. Silicone-covered, stranded HV wire is recommended in all cases by many technicians as a superior interconnecting wire involved with high voltages.

Next, in Figure 4C, we see the trouble that happened with the aforementioned glass capacitor. Any dielectric will break down if excessive voltage, temperature, or cycling of current at high frequency are individually or mutually applied.

Note the symptoms of this failure. Arcing can be between plates or directly over the edge of adjoining plates as shown in Figure 5. Edge arcing is also called "flashover."

In either case, it is likely that disassembly and replacement of the dielectric elements are required. This problem is manifested with many dry dielectrics, since sometimes a momentary overload will wreck your capacitor permanently. Various troubles arise when a capacitor isn't designed with an overbuild mind-set.

In all cases, except with very tightly sealed or oil immersed capacitors, you'll perceive that characteristic "electrical" smell of ozone gas. This gas is toxic — about 200 times more so than carbon monoxide — so apparatus giving it off as a by-product of operation or by accident needs to be operated in a well-ventilated area.

Ozone has the advantage of being detected in small amounts easily by its characteristic odor. Some people compare it to chlorox bleach. You'll also get a headache pretty quickly after being exposed to it. In that case, get out of the area and into fresh air.

Paraffin Wax as an Insulator?

Interestingly, paraffin is a rather super-cheap and effective insulator for the edges of capacitors. The caveat here is it must not get too hot, or it'll drip all over the place. Who hasn't taken apart an old radio, to discover the wax-sealed capacitors have dripped in their lifetime? The value of this substance is its availability and inexpensive price tag. Chart 2 shows the breakdown voltages of different dielectrics.

Chart 2
DC Puncture Voltages

Air = (See "Spark-Gap Voltages" Figures 6-8)
Paper (bond) = 200
Polystyrene = 500
Plexiglas = 450
Polyethylene Terphthalate (Mylar) = 7500
Pharmaceutical Mineral Oil (Squibb) = approx. 200
Ordinary Window Glass = 200
Polycarbonate (Lexan) = 400
Epoxy Circuit Board = approx. 700
PVC (rigid type) = 725
Polyethylene = 450
Teflon = 1000
Pyrex = 335
Silicone RTV = 550
Nylon = 407
Shellac = 200

Where different values were given for the same substance, the lowest value was chosen.

Insulation-wise, the distance between two electrodes with any capacitor, regarding their geometric shape, is

SOURCES

LNS Technologies, 20993 Foothill Blvd., Suite 307, Hayward, CA 94541; Inquiries: (510) 886-9296, orders: (800) 886-7150. Visible laser diodes and a driver kit, also carries a line of high-technology electronic kits. Accepts major credit cards. Catalog \$1.00.

MWK Industries, 1269 West Pomona, Unit 112, Corona, CA 91720; ph: (909) 278-0563, FAX: (909) 278-4887. Hours: 8-5 PST weekdays, 10-3 Saturdays. Free catalog. Source for new and used laser equipment, supplies, and optics. Carries a wide variety of He-Ne and other lasers suitable for the experimenter & hobbyist.

Geo-Monitor, 65 Washington Street, #400, Santa Clara, CA 95050; ph: (408) 749-6770, FAX: (408) 249-3780. Publishes a technical newsletter about earth science, and may be useful to those interested in using lasers to record seismic activity.

Edmund Scientific Company, 101 East Gloucester Pike, Barrington, NJ 08007-1380; ph: (609) 573-6250, FAX: (609) 573-6295. Free catalog. Supplier of a wide variety of educational and scientific equipment including lasers and an extremely comprehensive line of optics.

Midwest Laser Products, P.O. Box 2187, Bridgeview, IL 60455; ph: (708) 460-9595, FAX: (708) 430-9280. Free catalog. Carries new and used laser equipment and inexpensive start-up systems.

Mouser Electronics. Mouser is a first class hobbyist and industry supplier of a very wide range of new electronic parts, equipment, and supplies. Free catalog. Call (800) 346-6873 for catalog and location of facility nearest you.

Amidon Associates, P.O. Box 956, Torrance, CA 90508; ph: (310) 763-5770, FAX: (310) 763-2250. Hobbyist and experimenter supplier of ferrite materials in many shapes and sizes.

Digi-Key Corporation, 701 Brooks Avenue South, P.O. Box 677, Thief River Falls, MN 56701-0677; ph: (800) 344-4539, FAX: (218) 681-3380. Free catalog. Top quality new electronic parts supplier.

Imaging Concepts Bulletin Board Service. A free scientific bulletin board that contains, among other topics, laser information. Georgia area code. Parameters: 9600 baud, N81. Accessible 24 hours a day by calling (404) 466-3932.

Herbach & Rademann, P.O. Box 122, 17 Canal Street, Bristol, PA 19007; ph: (215) 788-5583, FAX: (215) 788-9577. Free catalog. An excellent experimenter source for quality mechanical, optical, electronic, and electromechanical surplus.

Viking Office Products. Quality office products of

all kinds at a discount. Listed here because of the value to the experimenter wanting to organize his or her laboratory. Viking features free catalogs and unsurpassed delivery promptness. Call (800) 421-1222 or FAX to (800) SNAPFAX [(800) 762-7329] for free catalog. Accepts prepaid, net 30, and credit card orders. Free delivery of orders over \$25.00 and free UPS pick-up of items that have problems or you aren't satisfied with.

Dyna-Art Designs, 3535 Stillmeadow Lane, Lancaster, CA 93536-6624; ph: (805) 943-4746, FAX: (805) 943-3776. Desk-top fabrication equipment for printed circuit boards; toner-transfer paper for easy hobbyist & OEM prototype do-it-yourself PC board making.

Society for Amateur Scientists, 4951 D. Clairemont Square, Suite 179, San Diego, CA 91777; ph/FAX: (619) 239-8807. nternet: scarlson@sas.org

The Electronic Goldmine, P.O. Box 5408, Scottsdale, AZ 85261. Free catalog. Ph: (602) 451-7454, FAX: (602) 451-9495. SMC components and a wealth of high-tech experimenter electronics, components, and project kits.

Industrial Fiber Optics, P.O. Box 3576, Scottsdale, AZ 85271-3576. Laser and fiber optic project kits primarily for the educational market. Sells mostly through distributors; Digi-Key is one. OEM sales as well. Ph: (602) 804-1227, FAX: (602) 804-1229.

Anderson Lasers, Inc., 2883 West Royalton Road, Broadview Heights, OH 44147. New and surplus industrial and scientific lasers & equipment. Carries high-power commercial grade equipment, not a hobbyist supplier. Professional inquiries contact: Richard Anderson, ph: (216) 237-6629, FAX: (216) 237-0656.

SuperCircuits, 13552 Research Blvd., #B, Austin, TX 78750. Order line: (800) 335-9777, Questions/Technical Assistance: (512) 335-9777, FAX: (512) 335-1925. Seller of microvideo products.

Images Company, P.O. Box 140742, Dept. N, Staten Island, NY 10314; ph: (718) 698-8305. Carries holography supplies, optical components, components for laser power supplies, stepper motors, CCD camera.

Amateur TV Quarterly, 1545 Lee Street, Des Plaines, IL 60018; Voice: (708) 298-2269, FAX: (708) 803-8994. Publisher of a magazine and several books geared to amateur TV. Mentioned here because of the general interest to experimenters and the parallel to our laser video endeavor. Contact them for the current pricing of a sample issue and brochure.

Small Parts, Inc., 13980 N.W. 58th Court, P.O. Box 4650, Miami, FL 33014-0650. Free catalog. Catalog requests: (305) 558-1255.

Be sure and mention *Nuts & Volts* when you contact the above suppliers so your request goes to the right department

critical to maintaining a good MTBF. Figure 6 shows the breakdown voltages {4} compared to several sizes of spheres and to needle points. This covers the span of 5 KV to 40 KV for air-dielectric capacitors, the most common voltage range of experimenter fabrications.

Notice how much lower the needle point breakdown voltages are? That is because of the fact that electrons are concentrated at any sharp point, thus precipitating lower breakdown voltages. Up to a point, as the spherical electrode diameter increases, the breakdown voltage increases. Then, a limit is reached whereby increasing the diameter of the electrode has little improvement upon the breakdown distance.

Figure 7 shows REALLY high-voltage capacitor data. These measurements go up to 300 KV. Techniques allied with the storage of such tremendous voltages are proprietary (industry secrets), but we can and will examine SOME of the known techniques in our next installment. Finally, Figure 8 shows mathematical correction factors for capacitors operating at different atmospheric pressures and ambient temperatures.

Conclusion

I received a couple of comments regarding a negative voltage power supply for our ongoing laser video project.

(Refer to last month's *Nuts & Volts*.) Since the MAX4112 current-mode feedback amplifier presented in that issue requires a NEGATIVE power supply of minus five volts potential, it's only logical to follow up with an example supply for this chip. I hadn't realized this was somewhat of a puzzle to some readers, so we'll give the schematic of an on-board minus five-volt supply, which we'll integrate into the video project as it continues to appear in future columns.

Next time, we'll take a look at how lasers might be used to communicate over astronomical distances, and look at how laser light can be shifted by present and future technological advances into x-rays, and possibly shorter wavelengths. Such wavelengths will retain information-carrying power over interplanetary or even interstellar distances. Plus, we'll continue our projects in progress with a closer look at homemade, high-voltage capacitors and laser video transmission. NV

Closing Quote:

"Science is, I verily believe, like virtue, its own exceeding great reward."

— Charles Kingsley (1819-1875)

REFURBISHED CELLULAR PHONES LARGE QUANTITIES OF CELLULAR PHONES

MOBILES - TRANSPORTABLES - PORTABLES

GREAT PRICES - WE DEAL

ALL PHONES ARE GUARANTEED

DEALERS WELCOME

CALL NOW! 800 423-2565

IN CALIF. 805-251-2244 FAX 805-252-3100

CSI REFURBISHED TELE-COMMUNICATIONS EQUIPMENT SINCE 1969

Write in 209 on Reader Service Card.

COMPUTER SOFTWARE *cont.*

INTERNET HELP for Windows 3.1. This disk is a comprehensive Windows help file that guides you in accessing and understanding the Internet. Think of it as your on-ramp to the info highway! Just \$7.95. Call 1-800-704-6500. Visa, MasterCard, & Discover accepted, or send check or money order for \$7.95 to: Computers, Etc., 204 Sonderen Street, O'Fallon, MO 63366.

TEKTRONIC COLOR printers: 4693DX 12 meg memory \$500, 4693DX 4 meg \$300, 4693D 4meg \$250, Phaser PX \$500, Phaser III for parts no motherboard or power supply \$500. Call Jerry after 6pm 505-294-1374 or contach@GNN.com

SHAREWARE PROGRAMS for IBM and compatible PCs. Write for your free catalog of the latest and best programs in shareware. (New LOW prices!) MicroData computer Services, 6510 Parkland Ave., Brook Park, OH 44142. Member of the ASP.

BUSTALK DIRECT PC port access software helps speed the debugging process for new PC I/O cards. Only \$10. Special Economies, 3 Margit Street, Wilmington, DE 19810. 302-475-5096.

CDs, FLOPPIES & VHS VIDEOS. Thousands of titles. CDs as low as \$5. Videos as low as \$8. Request "Software Flyer" free with monthly specials! Titles from family to adult. Credit cards accepted. Write or fax 501-223-9406. **Software City**, Box 23016, Little Rock, AR 72221.



UJ'S® CELLULAR EMULATOR SYSTEM, COMBO SALE, MARCH, APRIL, AND MAY, INCLUDES FREE, MOTOROLA'S NEW CELLULAR TECHNICIANS TRAINING MANUAL (212 PAGES OCT. '95). ALSO SALES, REFURBISHED CELLULAR PHONES. SEE OUR DETAILED ADS IN TELEPHONE/FAX CLASSIFICATION. LESS BUSTER'S ELECTRONICS, 702-642-0325.

FREE IBM based DTMF decoding program and schematic VIA the Internet. Send E-Mail address to PDRUNEN@AOL.COM Request by mail, send check for \$6 to Concept Technology, 8700 Turkey Bluff Rd., Navarre, FL 32566.

ELECTRONICS SHAREWARE programs, Yagi design, circuit drawing loaded dipole design, scanner database, bearing-distance calculator, QSL label program, eight programs on one disk. Send \$5 for shipping-handling to Richard Jewell, PO Box 6397, Beauty, KY 41203-6397.

SEMICONDUCTOR CROSS-REFERENCE LIBRARY on disk, for IBM PC with 640 mem, EGA or better, 10 meg HD space. Over 240,000 devices (transistors, diodes, ICs, SCRs, etc.) Specification, lead and case configuration drawings for most. Send \$49 to Custom Software Creators, PO Box 1092, St. Bethlehem, TN 37155. 615-647-6120.

BLACK BAG TRIVIA QUIZ on 5.25 MSDOS disk. Includes unique shareware and restricted book catalogs (over 21 only). **FREE!** Mentor Publications, Box 1549-N, Asbury Park, NJ 07712.

17,400 TECHNICAL TIP REPAIRS. Call for an absolutely **FREE** version of the **TIP PROGRAM. READ ON. VALUABLE, TIME SAVING TECHNICAL REPAIRS** for servicing TVs, VCRs, PROJECTION TVs, CAMCORDERS & other electronics, organized in an easy to use computer program. **The TECHNICAL TIP REPAIR program. PROFESSIONAL BOARD LEVEL & COMPONENT LEVEL REPAIRS** with part numbers, component locations, values & test voltages (when available). **ADD** your own tips. **PRINT** tips. Owners of our **COMPUTERIZED TIP PROGRAM** say this is the **BEST** technical tip program on the market today. Works on **ANY** IBM compatible computer with a hard drive. (Also works on some Apple Macintosh computers.) **NEW VERSION works in DOS and WINDOWS. SPECIAL SALE pricing EXTENDED for March. Only \$150. FREE shipping** for prepaid orders (USA). Call for COD. Have your own tips? Ask about our **TIP EXCHANGE** policy with **FREE updates!** Call for an absolutely **FREE** version of the **TIP program!** Just give us your name, address & phone # and that's it. It's really **FREE. CALL 1-800-215-5081/516-643-7740. HIGHER INTELLIGENCE SOFTWARE, 60 Farmington Lane, Melville, NY 11747.**

SECRET SUBJECTS ON A CD-ROM. Megabytes of useful information regarding cable TV, hacking, viruses, cellular phones, computers, free services, etc. Only \$69. Price includes shipping. Fax your order to 818-843-5173 and include your phone number for credit card verification or send a MO or cashiers check to: EDS, 120 S. S. Fernando Blvd. #101, Burbank, CA 91502-3122.

APPLE-II software, free catalog, \$1 disk, large selection. PMA-II, Box 2424, Scottsdale, AZ 85252. 602-496-6547.

CYRIX 6X86. Outperforms them all! Get maximum performance. You've read about it, now you can own one. In stock for immediate shipment. Want more info? Call 1-800-704-6500 or connect to [HTTP://WWW.COMPET.COM](http://WWW.COMPET.COM) Computers Etc., 204 Sonderen Street, O'Fallon, MO 63366. Visa, MasterCard, & Discover accepted.

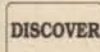
**Closing Date For Next Issue -
March 10th!**

ELECTRONIC TEST EQUIPMENT BOUGHT & SOLD

Ailtech 360D11, Frequency Syn., 01-2GHz	\$1,000	HP 8616A, Signal Gen. 1.8-4.5GHz AM/FM/Phase	\$200
Arbiter 1040A, Meter Calibrator, AC/DC/Voltage/Current	\$1,200	HP 8620A, Sweeper Mainframe	\$250
Astrosystems A1202S/R-01, Decade Synchro Resolver Standard	\$800	HP 8620C, Sweeper Mainframe	\$400
Austron 1250A, Crystal Frequency Standard	\$350	HP 8621B, RF Draw, with 86350A, 8-12.4GHz, 8620C	\$400
Bacharch MV2, Mercury Vapor Detector	\$100	HP 86220A, RF Plug-in, 10-1300MHz, for 8620C	\$600
Bafco 911A, Frequency Response Analyzer (unused)	\$400	HP 86235A, RF Plug-in, 1.7-4.3GHz, for 8620C	\$400
Ballantine 1627A, Scope Calib., with vac. heads, & Computer	\$1,200	HP 86240B, RF Plug-in, 2-8.4GHz, for 8620C	\$500
B&K 520B, Transistor Tester, In/Out Circuit	\$150	HP 8654A, Signal Gen. 10-520MHz AM/FM	\$500
Boonton 250A, RX Meter, Same as HP	\$250	HP 86601A, RF Plug-in, 110MHz	\$250
Boonton 62AD, Inductance Meter, 1MHz, 2-2000µh	\$250	HP 86602B, RF Plug-in, 1300MHz	\$500
Boonton 92B, RF Millivolt Mtr. with Probe Kit	\$350	HP 8683A, Signal Gen. 2.3-6.5GHz, Opt 1, 2	\$1,500
Bruel & Kjaer 2107, Frequency Analyzer	\$200	HP 8684B, Sig. Gen. 5.4-12.5GHz AM/WBFM, Pulse	\$2,000
Bruel & Kjaer 2305, Level Recorder	\$350	HP 8743B/018, Reflection Trans Test Set, 2-18GHz	\$400
Data Precision 6000, Wave Analyzer, 620 Plug-in	\$1,000	Ithaco 3512, Ratiometer Lin. Log	\$250
Datel DVC8500, DC Voltage Calibrator 10uV-10V	\$100	Ithaco 393, Lock-in Amplifier	\$200
DDC SR-400, Synchro Resolver Simulator	\$400	Keithley 169, Digital Multimeter	\$80
EDC MV106G, DC Voltage Standard, 01uV-10V	\$200	Krause Storke 5000, Sweeper, 500-1000MHz	\$250
ESI 296, Auto LCR Meter	\$800	Leeds & North 1091, Capacitor Decade, .001uF-1uF	\$150
Exact 627, Funct. Generator, 13MHz 100mV-10V, Digital Fairchild DBMC101, Data Bus Tester	\$450	Leeds & North 4287-3, Kelvin Bridge	\$100
Fluke 332B, DC Voltage Standard 0-1100VDC	\$400	Marconi 2022A, Signal Gen. 10KHz-1GHz AM/FM	\$2,000
Fluke 3330B, DC Voltage, Current Calibrator	\$500	Marconi TF2015/2, Signal Gen. 10-520MHz AM/FM, Mod.	\$200
Fluke 335A, DC Voltage Standard, 0-1100VDC	\$800	Marconi TF2300A, Modulation Meter, 1000MHz	\$350
Fluke 5200A, Programmable AC Voltage Standard HPIB	\$1,600	Micro-Tel SG800, Swept Signal Generator, 1-18GHz	\$2,000
Fluke 540B, Thermal Transfer Standard	\$900	Millivac MV-928A, RF Millivoltmeter with Probe Set	\$100
Fluke 750A, Reference Divider	\$600	Narda 7000A/7202/7206, Microwave Multitr., 01-18GHz	\$1,000
Fluke 8010M, Digital Multimeter	\$70	Narda 792FF, Attenuator, 2-12.4GHz 0-20dB	\$100
Fluke 8500A, Digital Multimeter 6.5 Digits, DC Only	\$250	North Atl 540/10, Resolver Synchro Bridge	\$800
Fluke 8502A, Digital Multimeter, Opt. 2, 3, 4, 5, 8A	\$500	Panametrics Epoch 2002, Ultrasonic Flaw Det.	\$1,000
Fluke 8505A, Digital Multimeter	\$500	Phillips 3211, Scope, 15MHz 2Ch.	\$200
Fluke 8506A, Thermal RMS Multimeter HPIB	\$1,400	Phillips PM3260, Scope Dual Trace Delayed Sweep	\$250
Fluke 8921A/03, True RMS Voltmeter	\$600	Phillips PM3267, Scope, 100MHz, Dual Trace, Delayed Sweep	\$400
Fluke 9010A, Micro-System Troubleshooter Opt. 001	\$200	Polarad 1105 E-L, Sig. Gen., 1020A Modulator, 8-2.4GHz	\$300
Fluke A90, Current Shunt	\$200	Polarad 1207, Signal Source 3.8-8.2GHz	\$200
Fluke Y800B, Touch Hold Probe	\$40	Polarad 640-1, Spect. Anyz., .003-18GHz Dig. Storage	\$1,200
General Radio 1538A, Stroboscopic, Strobe Scope	\$400	Polarad SPNH, Generator 20Hz 20KHz	\$450
General Radio 1650A, Impedance Bridge	\$200	Power Designs TW5005D, Dual Output Power Supply/Digital 0-50V	\$100
Glow-Mac 20-500, Portable Inertness Analyzer, Unused	\$250	Powerlec 6D6000, Power Supply, 6 Outputs, Adj., Metered	\$200
Guideline 9152/P4, Standard Cell, Double Oven	\$300	PPM R5, Resistor Standard, 1-111.1K, 1 Ohm Res	\$150
Halcyon 520B3, Universal Test System	\$500	Racal Dana 9035/11A, Computer Counter, Opt. 01/06/55, unused	\$300
Hameg HM 208, Digital Storage Scope, Unused	\$600	Racal Dana 9303, True RMS RF Level Meter	\$800
Hiptronics HDA10, Hipot Tester 0-10KV	\$300	Racal Dana 9515, Universal Counter, HPIB, Opt. 41	\$200
HP 105A, Quartz Frequency Standard	\$600	Schlumberger 7061, Systems Voltmeter, 7.5 Digits	\$700
HP 11049A, Thermal Converter, 3 Volts	\$100	Schlumberger SI-1253, Gain Phase Meter	\$1,000
HP 1120A, Active FET Probe Kit, 500MHz	\$150	Sencore TF30, Super Cricket Transistor Tester	\$200
HP 1121A, Active Probe, 500MHz, Kit w/Dividers	\$200	Syston Donner 100A, Pulse Generator	\$100
HP 1122A, Probe Power Supply	\$200	Syston Donner 6243A, Counter 1.2GHz, 1Hz Res	\$200
HP 1124A, 100MHz Active Divider Probe, Unused	\$100	T.B.E. 208, C, L Meter, 1F-10uF, 1nH-10H	\$300
HP 1200A, Scope, Dual Trace, 1mV-20V	\$100	Tek 106, Square Wave Generator	\$100
HP 11605A, Flexible Arm, Opt. 018	\$200	Tek 114, Pulse Generator	\$100
HP 1415A, Time Domain Reflectometer Plug-in, 141T	\$200	Tek 1502/04, TDR Cable Tester, with Chart Recorder	\$1,495
HP 15453A, Ten Bit Address Probe	\$50	Tek 1503, TDR Cable Tester 0-50,000 Ft.	\$1,295
HP 15454A, Control Probe Driver	\$50	Tek 178, Linear IC Test Fixture, For 577	\$300
HP 1815A/1816A, TDR/Sampler, DC-4GHz	\$400	Tek 213, DMM Oscilloscope, Portable Battery Oper.	\$400
HP 3300A, Function Gen. with 3302A Phase Lock	\$150	Tek 4041, Systems Controller for GPIB	\$200
HP 3320A, Frequency Synthesizer	\$250	Tek 464, Scope/100MHz Dual Trace, Storage	\$500
HP 3325A, Synthesized Function Generator	\$1,800	Tek 465, Scope 100MHz Dual Trace	\$400
HP 3330B, Automatic Synthesizer	\$400	Tek 466, Scope, 100MHz Dual Trace, Storage	\$600
HP 4000A, RMS Voltmeter 1mV-300V, 10Hz-10MHz	\$150	Tek 466/D44, Scope, 100MHz, Storage, DMM	\$650
HP 4030C, True RMS Voltmtr. dB, Auto Range, HPIB	\$350	Tek 475, Scope, 200MHz, Dual Trace	\$500
HP 4060A, Broadband Sampling Voltmtr. to 1.2GHz	\$250	Tek 491, Spectrum Analyzer 10MHz-12.4GHz	\$600
HP 3455A, High Accuracy Voltmeter 6.5 Digit	\$400	Tek 492, Spectrum Anyz. 50KHz-21GHz Opt 1, 2, 3	\$5,000
HP 3456A, Digital Voltmeter, 6.5 Digits	\$700	Tek 577/177, Transistor Curve Tracer	\$1,000
HP 3457A, 6.5-7.5 Digit Multimeter, LCD Display	\$2,000	Tek 624, XY Monitor	\$200
HP 3465A, Digital Multimeter	\$100	Tek 7403N, Scope Mainframe, Rack Mount	\$200
HP 3570A, Network Analyzer	\$500	Tek 7A18A, Dual Trace Amp	\$100
HP 3575A, Phase Gain Meter, Opt. 01, Dual Displays	\$600	Tek 7A29, 1GHz Vert. Amp, 7000 Series Mainframe	\$450
HP 3580A, Spectrum Anyz., 5Hz-50KHz, 1Hz Res	\$800	Tek 7A29/04, 1GHz Vert. Amp Variable Delay	\$500
HP 3581C, Selective Level Meter	\$600	Tek 7B85, 400MHz Delaying Time Base	\$150
HP 3582A, Spectrum Anyz., 0.2Hz-25.599KHz	\$2,000	Tek 7CTIN, Curve Tracer Plug-In	\$350
HP 3586C, Selective Level Meter, 50 Ohm	\$1,000	Tek 7D11, Digital Delay Plug-in for 7000	\$100
HP 394A, Attenuator, 1-2GHz, 200 Watts	\$125	Tek 7L13/7623, Spectrum Anyz. 1KHz-1.8GHz	\$2,000
HP 432A/478A, Power Mtr., Cable, Mount, 10MHz/10GHz	\$300	Tek 7L18/7603, Spectrum Anyz. 1.5-18GHz Dig. Storage	\$3,000
HP 435A/8481A, Power Mtr., Cable, Sensor, 10MHz/18GHz	\$800	Tek 7S12, TDR/Sampler, No Heads	\$400
HP 456A, AC Current Probe	\$100	Tek DC502/01, Frequency Counter 10Hz-550MHz, TM500	\$300
HP 4815A, Vector Impedance Meter	\$900	Tek DC503, Universal Counter Timer TM500	\$150
HP 5110B, Synthesizer Driver & Cable Set	\$300	Tek DC503A, Universal Counter, 125MHz TM500	\$200
HP 5300B, 5308A, 75MHz Timer Counter	\$200	Tek DC504, Counter/Timer TM500	\$100
HP 5328A, Universal Counter, 500MHz, HPIB	\$350	Tek DM502, Multimeter TM500 Modular System	\$100
HP 5334A, 100MHz Universal Counter, HPIB	\$1,400	Tek DM504A, Autoranging DVM/TM500 System	\$200
HP 5340A, Frequency Counter	\$800	Tek FG501, Function Generator	\$200
HP 5340A, Frequency Counter, LEDS & HPIB, 18GHz	\$1,000	Tek LA501W/WR501, Logic Analyzer	\$150
HP 54200A, Digital Storage Scope, Dual Trace, 200MG/S	\$1,500	Tek P6016, Current Probe with Termination	\$150
HP 6177C, DC Current Source 0-50V, 0-500mA	\$300	Tek P6045, FET Active Probe	\$100
HP 7015B, XY Recorder	\$200	Tek P6136, Scope Probe 350MHz (Unused)	\$100
HP 741B, DC Voltage Standard/Diff Volt Mtr.	\$200	Tek P6201, FET Probe Kit, 900MHz	\$350
HP 745A, AC Calibrator, 1mV-10V 10Hz-110KHz	\$350	Tek PS501-1, Power Supply 0-20V, TM500	\$150
HP 7790, Directional Coupler, 1.7-12.4 GHz	\$200	Tek PS503A, Dual Tracking Power Supply, TM500	\$200
HP 8018A, Serial Data Generator	\$300	Tek S3, Sampling Head	\$100
HP 8405A, Vector Voltmtr with Acos	\$400	Tek S3A, Sampling Head	\$150
HP 8410B, Network Analyzer	\$200	Tek S5, Sampling Head	\$100
HP 8412A, Phase Magnitude Display	\$200	Tek S53, Trigger Recognizer Head	\$350
HP 8443A, Tracking Gen., 100K-110MHz LED Display	\$400	Tek SG502, Sig. Gen. 5Hz-50KHz TM500 Sys.	\$200
HP 8444A, Tracking Generator	\$800	Tek SG503, Sig. Gen. 250KHz-250MHz	\$600
HP 8444A/059, Tracking Generator	\$1,000	Tek TM503, Mainframe 3 Slot, TM500	\$100
HP 8445B, Spectrum Anyz., Automatic Pre-Selector	\$400	Tek TR-503, Tracking Gen. 1-1800MHz for 492, 4, 6	\$1,000
HP 8481A, Power Sensor, with Cal. Sheet	\$400	Tek WM4902, Waveguide Mixer Set, 18-40GHz, 492	\$1,000
HP 8553B, Spectrum Anyz., RF Plug-in, 1K-110MHz	\$200	Vu-Data 5110, Semiconductor Tester, In/out Circuit	\$400
HP 8553B/8552B, Spect. Anyz. 141T System, 1K-110MHz	\$1,000	Wavetek 1002, Sweep/Sig. Gen. 0-500MHz with Markers	\$250
HP 8554L/8552B, Spect. Anyz. 141T System, 100KHz-1.2GHz	\$1,400	Wavetek 114, Sweep/Trigger VCG	\$100
HP 8555A/8552B, Spectrum Anyz., 141T System, 01-18GHz	\$1,600	Wavetek 144, HF Sweep Gen. .0005Hz/10MHz	\$200
HP 8557A/180TR, Spectrum Analyzer, 01-350MHz	\$1,000	Wavetek 145, 20MHz Pulse/Function Generator	\$300
HP 8559A/182T, Spectrum Analyzer, 01-21GHz	\$3,000	Wavetek 154, Programmable Waveform Gen. 001Hz-10MHz	\$350
HP 8614A, Signal Gen. 8-2.4GHz	\$250	Wavetek 3001, Signal Gen. 1-520MHz, AM, FM	\$600
		Wavetek 750, Phase Meter, 10Hz-2MHz, 1mV-340V	\$150
		Wavetek 859, Programmable Waveform Gen.	\$1,000
		Wavetek 907, 7-11GHz Signal Generator	\$650

PHELPS INSTRUMENTS

2631 Hillside Ave., Norco, CA 91760 • 909-279-7347



Write in 170 on Reader Service Card.

Nuts & Volts Magazine/March 1996

COMPUTER EQUIPMENT WANTED

WANTED: PRE1980 Microcomputers for museum collection. Microcomputer magazines and manuals also needed. 703-231-6478, 703-763-3311.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 513-847-2300 OR fax 513-847-2350.

WANTED: ZENITH portable laptop computers. If you have a Zenith laptop to sell, call Les or Mike, 616-849-1800.

DID YOU KNOW that old personal computers, monitors, modems, electronic cash registers, and even old calculators contain valuable IC chips that are plated with pure gold! My "Big Color Photo" (8" x 10") shows over 25 of the most common gold plated IC Chips and the price I will pay for them. Chips are shown actual size. The price of gold keeps climbing higher and higher and is making it worthwhile to tear apart old equipment. To order "The Big Photo" send \$15 to Jim Sciuto, Box 128, Methuen, MA 01844.

WANTED: COMPUTERS, parts & software. Quantity lots of laptops, lasers, memory, drives, VGA-monitors, faxes, copiers, etc. Used/unused/as-is. 914-738-6830.

WANTED: DEC PDP-8 computer and accessories. Please state price. Brad Fayette, 32801 Hwy. 441 North #250, Okeechobee, FL 34972.

HP CALCULATORS with LED display wanted for private collection. Will pay up to \$200 for model 10, 37E, 46, 70, 81, 91, 92, 97S, others. Bob Morrow, 317-855-2348, rkmorrow@aol.com

LCD COLOR PANELS/PROJECTORS WANTED working or not. Fax description and price to 610-935-7666 or call 610-983-0100 ask for Neil.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Now selling memory. We can beat any printed price in Nuts & Volts. Call 1-800-4-MEMORY now! Voice/FAX.

WANTED: DAMAGED laptop computers (must be color). Also non-working Rolex and Accutron watches and Motorola flip phones. Call, 302-836-5504.

WANTED: TRS-80 Pocket Computer Model PC-2 technical manuals, RS232 interface, expansion modules, and software. Please E-Mail me at ddeutscher@aol.com

BUYING NON-WORKING IBM Thinkpad model 700/700C parts, or whole units. Call eves. EST, 718-965-3442.

HP 100/200 palmtop wanted. Please fax info and price to 407-859-5289 or send to COMACS, 4400 Raymar Drive, Orlando, FL 32839.

WANTED: MFM hard drives: NEC D-3142; Maxtor XT-1085, XT-1140, XT-2190; Seagate ST-125, ST-138, ST-251, ST-1100; Toshiba MK134FA. Call 714-542-1037 or Fax 714-835-1575.

PRINTHEADS WANTED. We buy all quantities of dot matrix printheads for hundreds of printer model types. Working or dead units acceptable. Call Mike Anderson @ 1-800-969-0009.

386 NOTEBOOKS, USED, WILL BID LOT QUANTITIES ONLY. WANTED VIZ: GRID 1755 ETC., WITH MINIMUM 20M, HD AND 1.44M FLOPPY. LB COMPANY 702-642-3558.

PERMANENT WANT: Children's home computer systems, accessories, software, books, magazines, etc. 218-587-2940. Stephanie Ring, Box 132 HCR3, Staples, MN 56479.

AT&T UNIX PC. I've got an AT&T 3B1/7300 with 2MB memory, and I'm looking for ANY size memory board (my friend has a machine with only 512KB memory) or a combination RAM/communications board. Please call 312-642-7237 (has answering machine).

TEST EQUIPMENT

DC TO GHZ! Three Spectra-Physics 125A helium-neon 76 inch LASERS plus 96 inch flowing gas laser, \$2,800. LASER bed, 14x42 stainless, 21.3" travel, motor, \$450. Telemation TMM-203 optical multiplexer, \$1,250. QMS 2400 Laser Graphics printer, \$1,200. Iveron-Pacific 2500B dual loop controllers, programmable, 3 \$1,400. HP 7935 cache memory, big but modern \$1,800. HP 1310B color display, \$450. IDS 1310 TDM-modem test set, 3 nixie, small \$120. EMR/Shlumberger 515 PAM/PDM synchronizers, \$145. Sierra/Philco 340A envelope delay test set \$375. Atlanta Research PPC-1 pressure pulse calibrator 30psi \$240. EEL 136-A phase lock synchronizer, 1-40 GHz, \$350. McGraw-Hill Encyclopedia Science Technology \$120. Fiber optic cable, meters, analyzers. Pressure standards, transducers, gauges. Spectrum analyzers, generators, communication, microwave gear. OBO. For huge list, 3 stamps. Also send your lists. Art, 4601 Yellowleaf, Fort Worth, TX 76133. 817-370-2575.

MODULAR POWER SUPPLIES open frame 5V/3A \$30, 5V/6A \$35, enclosed 0-7V/1A \$45. $\pm 15V/150mA$ \$35, 5V/13A \$60, 24V/10A (220VAC input) \$75. Tested and guaranteed. 516-487-9797 Alan.

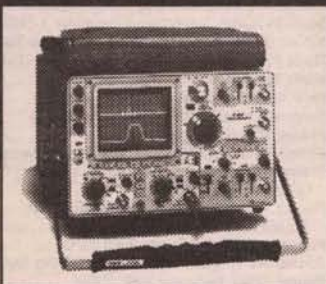
WANTED: SERVICE MONITORS. WE BUY IFRs, MARCONI 2955/2957, LATE MODEL MOTOROLA UNITS, ALSO SOME CUSHMAN UNITS. WE PAY WITHIN 24 HOURS OF EVALUATION. CALL 601-868-6596 OR FAX INFO TO 601-868-0133.

WANDEL & GOLTERMANN level meter SPM, 19 50Hz to 25MHz \$795. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

FREQUENCY SYNTHESIZER HP 8660C frame with HP 86603A and HP 86633B plug-ins. Frequency range 1 to 2600 MHz including AM/FM capability. Has sweep capability and calibrated RF output from -140 to +10 dBm. Includes opt. 5 with HPIB. Units are in excellent condition and come with certificate of calibration (NIST) including 30-day warranty. Priced at \$3,850. Coppes Electronics, 520-432-1229.

WANTED: WESTERN electric test equipment. Tube-type only please. Freq. measuring sets, oscillators, amplifiers, parts, tubes, etc. 1-800-251-5454.

Quality Reconditioned Test Equipment



Tektronix 485 Oscilloscope

350 MHz bw, dual trace, 5 mV/div sensitivity, 1 ns/div sweep rate, 3.0 div/ns writing speed, selectable input impedances.

Special \$1000.00

Tektronix 465 Oscilloscope

100 MHz portable scope, dual trace, 5 mV/div sensitivity, 5 ns/div sweep rate, 8 x 10 cm CRT. Includes 2 probes.

Special \$595.00

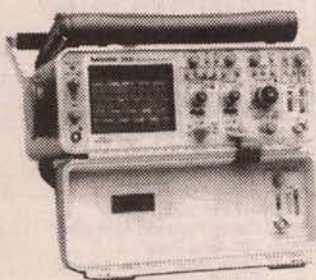
Tektronix 7834 Oscilloscope

Storage oscilloscope mainframe, 2500 c/us stored writing speed, dc to 400 MHz, multimode storage. Includes (1) 7A19 amplifier, (1) 7A26 dual trace amplifier, (1) 7B85 delaying time base & (1) 7B80 time base.

\$1000.00

Tektronix 2336 Oscilloscope

100 MHz field service oscilloscope, 5 mV/div to 5 V/div, 5 ns/div sweep rate, delta time on the flip top cover.



\$1250.00

Tektronix 454 Oscilloscope

Dc to 150 MHz, 5 mV/div sensitivity, dual trace, .05 μ s to 5s/div timebase plus sweep delay circuit.

Special \$450.00

Hewlett-Packard 8447A

RF Amplifier, 0.1 to 400 MHz, 20 dB gain. Options available.

\$350.00

Hewlett-Packard 8569B

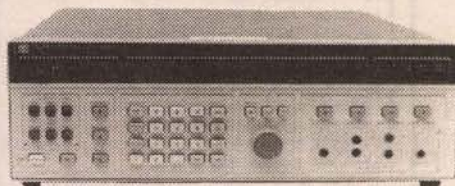
Spectrum Analyzer, 0.01 to 22 GHz with internal mixer, expendable, internal preselection, 1.7 to 22 GHz, 100 Hz to 3 MHz resolution range.

\$9200.00

Hewlett-Packard 3336B Synthesizer/Level Generator

Frequency coverage is from 10 Hz to 21 MHz, making the 3336B useful for telephone circuit loop testing on most FDM systems. Includes opt 005. Like new.

\$850.00



Hewlett-Packard 3586B Selective Level Meter

Makes carrier measurements to 32.5 MHz, voice channel measurements from 50 Hz to 100 kHz, can use the 3336B Level Generator as an automatic tracking generator. Opt 004. Like new condition.

\$850.00

Hewlett-Packard 5334A

Universal Counter, two channel, 100 MHz counter with 9 digits in one second resolution and 2 ns single shot time interval resolution. Automatic rise/fall time, pulse width and peak amplitude measurements.

\$1650.00

Hewlett-Packard 3456A

Digital Voltmeter, 6.5 digit system is ideal for bench/system applications. Measures dc, true RMS, ac voltage and resistance. Five full scale dc ranges from 0.1 V to 1000 V. 100 nV resolution, 100 Ω to 1 G Ω resistance in 8 ranges.

Special \$800.00

Hewlett-Packard 8656B Signal Generator

100 kHz to 990 MHz, 10 Hz resolution, ± 1.0 dB absolute level accuracy, amplitude offset and phase adjustment capability, 150 ms frequency switching speed, versatile simultaneous modulation including dc FM, fully HP-IB programmable, options available.

\$5000.00

Hewlett-Packard 8901A

Modulation Analyzer, 150 kHz to 1300 MHz, measures AM/FM to 1% accuracy. Measures RF frequency and RF power, completely automatic. Options available.

\$5500.00

Hewlett-Packard 8903A

Audio Analyzer, measures distortion, SINAD, signal-noise, frequency (20 Hz to 150 kHz), and ac and dc level voltage. Options available.

\$2750.00

Tektronix 2754P

Programmable Spectrum Analyzer, 10 kHz to 21 GHz, -117 to +30 dBm, resolution 1 kHz to 3 MHz.

Special \$9900.00

Hewlett-Packard 3325A

Synthesizer/ Function Generator, 1 μ Hz to 21 MHz, wideband sweeper, programmable, 11 digit.

\$2000.00

Tektronix 492 Opt 01, 02

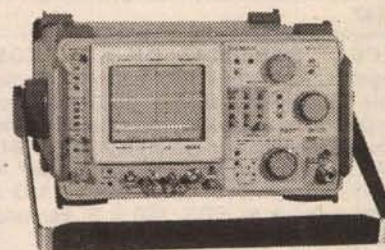
Spectrum Analyzer, 50 kHz to 21 GHz, 80 dB dynamic range, amplitude comparison in 0.25 dB steps, opt 01 internal preselection & opt 02 digital storage.

\$7500.00

Tek 492 opt 01, 02, 03

Spectrum Analyzer see above. Opt 03 adds frequency stabilization/ 100 Hz resolution.

\$8250.00



WANTED USED TEST EQUIPMENT!



Please call for our Free 1995 Catalog

14455 NORTH 79TH STREET, UNIT #C • SCOTTSDALE, ARIZONA 85260
(602) 483-6202 • Fax (602) 483-6403

SIGNAL GENERATORS/OSCILLATORS HP 8656A/001 100kHz to 990MHz synthesized signal generator \$2,995, HP 8640B 512MHz signal generator \$1,795, HP 8640B/001/002 1024MHz signal generator \$2,795, HP 8683B 2.3 to 6.5GHz signal generator \$1,550, HP 8620C sweeper mainframe \$395, HP 86290C 2 to 18.6GHz RF plug-in \$2,395, HP 86222B 0.01 to 2.4GHz RF plug-in \$1,795, HP 204C 5Hz to 1.2MHz audio oscillator \$125, HP 651B 10Hz to 10MHz test oscillator \$125, HP 654A 10Hz to 10MHz test oscillator \$175, HP 8660D/100 synthesized signal generator \$2,500, HP 86602A 1200MHz RF plug-in \$895, HP 4204A 10Hz to 1MHz digital oscillator \$150, GIGATRONICS 900/0.5-12 50MHz to 12.4GHz synthesized signal generator \$2,995, WAVETEK 1062A 400MHz sweep generator \$595, WAVETEK 952 1 to 4GHz microwave source \$995. **30-day warranty & manual.** Calibration available. MasterCard & Visa accepted. **CALL 1-800-435-1516, FAX 908-280-0111.**

HP 3570A Network analyzer in good condition \$350. 415-244-9254.

PORTABLE SCOPES: Tek 465 (100MHz) \$425. Tek 465B/DM44 (100MHz, multimeter) \$590. Tek 475A (250MHz) \$675. Tek 485 (350MHz) \$790. HP 1727A (275MHz, storage) \$890. Tek 466 (100MHz, storage) \$790. Tek 2465 (300MHz) \$2,190. All with bright CRTs; excellent condition, warranty. Pepper Systems, 214-353-0257.

METERS HP 419A null meter, \$200; HP 427A multifunction VM, \$100; HP 403B, \$100; HP 415E SWR meter, \$150; Boonton 93A RF VM, \$150; HP 432A power meter and probe, \$300; HP 435A, \$150; HP 3400A, \$250; HP 400E, \$250; HP 331A distortion ana., \$300; HP 334A, \$500; Fluke 893A, \$150; HP 428B current meter and probe, \$300; HP 4328A milliohmmeter and probe \$650; HP 400F, \$250; HP 3420A differential VM, \$200; HP 3420B, \$250; Fluke 8010M, \$100; Fluke 8010A, \$100; HP 3455A, \$500; HP 3465A, \$150; Tektronix 130 LC meter, \$200; Keithley 503 milliohmmeter, \$200. A-Comm Electronics, 303-290-8012, FAX 303-290-8133.

HP 6453A power supply 0-15 volt 0-200 amp, \$995. Dexis, 612-944-7670.

DISTORTION ANALYZERS HP 334A \$495, HP 332A \$295, HP 331A \$195, **SOUND TECHNOLOGY 1700B** distortion measurement set \$895, **30-day warranty & manual.** MasterCard & Visa accepted. **CALL 1-800-435-1516, FAX 908-280-0111.**



DIGITAL PHASE METERS 10Hz to 30MHz 0.01 Deg resolution, 4 1/2 LED display, auto-gain autozero, no adjustments, accepts any waveforms from 5mV to 50V peak. Prices start at \$395. **FREE** application manual for asking. **DIGITAL C, L METERS** Accurate bench top instruments with 0.001 pF and 0.001 uH resolution. Test frequency 1MHz down to 1kHz, accuracy 0.2%. Many more features, factory new. Prices start at \$380. All equipment manufactured in USA by TBE Electronics, PO Box 42, Candor, NY 13743. Tel. 607-659-3030/FAX 607-659-3650.

WANTED: MEASURING & Test equipment, microwave components, RF connectors, etc. **Top price paid!** Write or FAX you list to: **Steigerwald GmbH**, Ungererstrasse 180, D-80805 Munich, Germany. FAX 011-49-89-3615899.

NEW MINIATURE rubidium oscillators type FRS manfd. 1995. Sealed boxes. \$1,100. Edward, 718-336-2015.

EQUIPMENT MANUALS we have 1000's of service and operators manuals for all types of test and measurement equipment from 1950 to present. All test equipment manufacturers are represented. Call, write, or fax your want list. Please include mfg.'s manual P/N unit serial numbers if known. **Manuals Plus**, Box 937, Spanaway, WA 98387. 206-531-8031 or FAX 206-536-1121.

POWER SUPPLIES, ETC. Sorensen SRL 40-50 0-40V 0-50A \$800. HP 6002A/001 autoranging 200 watt programmable \$700. HP 6227B 0-25V 0-2A dual tracking \$475. HP 6443B 0-120V 0-2.5A \$425. **Tek PS 503A** \$235. **Xentek EIT 2.5-2** extreme isolation transformer (2.5KVA, 115V) \$250. Other ratings available. **Kikusui PLZ 300W** electronic load \$425. Pepper Systems, 214-353-0257.

TEKTRONIX VERTICAL AMPS: 7A42 350MHz 4 channel \$595. 7A13 105MHz differential \$350. 7A22 1MHz high sensitivity, differential \$375. 7A18 75MHz \$50. 7A18A 75MHz \$75. 7A18/6 (variable offset) \$110. 7A26 200MHz \$135. 7A24 400MHz \$250. 7A29 1000MHz \$750. Excellent condition, warranty. Pepper Systems, 214-353-0257.

FUNCTION GENERATORS, TEK FG501 2Hz to 2MHz \$195, TEK FG502 1kHz to 11MHz \$295, HP 3311A 0.1Hz to 11MHz \$195, Philips PM5191 programmable synthesized function generator 0.1MHz to 2MHz/IEEE \$895, **30-day warranty & manual.** Calibration available. MasterCard & Visa accepted. **CALL 1-800-435-1516, FAX 908-280-0111.**

FLUKE BENCH METERS. 8010A, 3.5 digit, has bat. opt. \$150. 8012A, 3.5 digit, has bat. opt. \$175. 8050A, 4.5 digit, has bat. opt. with factory carrying case, \$250. 8810A 5.5 digit \$250. 8840AF, 5.5 digit \$650. All units sold with cord, probes, certificate of calibration (NIST), and 90-day warranty. All units in excellent condition. Coppes Electronics, 520-432-1229.

TIRED OF paying high prices to get Tektronix, Hewlett Packard, Wavetek, IFR, etc., repaired, calibrated, certified? Give us a call. Free estimates, fast service. We also sell and rent test equipment. For information: Feitek, 2752 Walton, St. Louis, MO 63114. 314-423-1770.

POWER SUPPLY SPECIALS. HP 6291A, new color, exc. cond. 0-40 VDC, 0-5 amps, \$300. HP 6267B, new color, exc. cond. 0-40 VDC, 0-10 amps, \$350. Sorensen DCR 150-12B, good cond. 0-150 VDC, 0-12 amps, \$650. Electronic Measurements TCR 160T15, exc. cond. 0-160 VDC, 0-15 amp \$650. Lambda LK-350 0-20 VDC, 0-35 amps, good cond. \$350. All units come complete with calibration certificate and 90-day warranty. Coppes Electronics, 520-432-1229.

RAINBOW KITS

Many of our kits are available completely built



FM STEREO TRANSMITTER

Own your own FM radio station. Any stereo signal you plug into the FMST-100 will be transmitted to any FM radio tuneable from 76 to 108MHz FM. Transmit a wireless link through an auditorium, from your car to your camper, listen to your CD's while mowing the lawn, Play music on one channel sing on the other. Clarity is excellent, approx. 40dB stereo separation. Length of antenna determines the distance of transmission. Complete with stereo input level controls & crystal for stereo separation. 9v battery operation. SIZE: 1.5" x 2.5" x 3"

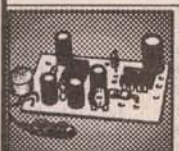
FMST-100 Cabinet \$8.95 KIT \$29.95



PHONE TRANSMITTER

Small but mighty, it fits anywhere. Phone line powered, never needs batteries. Transmits both sides of a phone conversation loud and clear, wireless, to any FM radio at great distances. Variable tunes from 70MHz to 130MHz FM. You can also use it as a speaker phone. SIZE: 1.25" x .6".

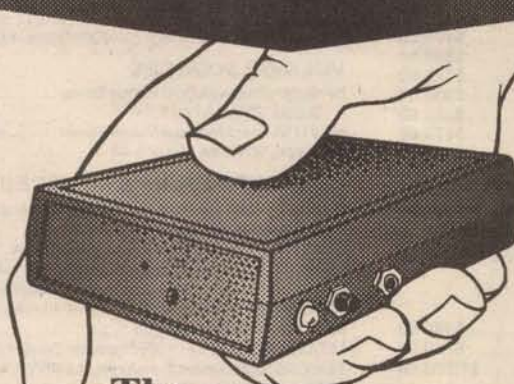
TEL-B1 BUILT \$29.95 KIT \$12.95



SUPER SNOOPER BIG EAR

Listen through walls, hear conversations across the room. Add a parabolic reflector and hear blocks away. The BIG EAR can be hidden anywhere. Makes an ultra sensitive intercom. Can be used as a 1.5W AMP. We supply a mini-electret mike in the kit. Power requirement 6 to 12v DC. SIZE: 1.75" x 1"

AA-1 BUILT \$29.95 KIT \$10.95



The "ZAPPER II"

With it's new and improved design it will not only test your radar detector...BUT it's tuned to the amateur radio band.

- While your out on American highways personally test yours and your fellow travelers radar detectors.

The "ZAPPER II" is a 10.450 GHz to 10.550 Transmitter

KIT \$39⁹⁵ BUILT \$49⁹⁵



This Manual contains schematics, parts lists & P.C. board layouts for many of the Rainbow Kits. Use your own parts to construct our kits.

KIT BOOK \$14.95

\$9.95 with the purchase of any kit.



WIRELESS FM MICROPHONE

Small but mighty this little jewel will out perform most units many times its price. It really stomps out a signal. The WM-2 kit is a buffered wireless mike that operates from 80MHz to 120MHz

FM, the frequency of any broadcast FM radio. Includes a mini-electret mike. 6 to 12v DC. SIZE: 1.25" x 1"

WM-2 KIT \$14.95



MICRO-MINIATURE PHONE TRANSMITTER

We haven't seen a smaller phone transmitter than the MMPT2 kit. Powered by the phone, it requires no battery. Transmits both sides of a phone conversation to an FM radio up to a 1/4 mile away. Tunable from 88 to 108MHz FM. Attach it to one phone or add it to the line to pick up all incoming calls. The MMPT2 is undetectable if properly installed. Unit has surface mounted parts, you install the leaded parts. Size .45" x .6"

MMPT2 KIT \$29.95



MICRO-MINIATURE WIRELESS MIKE

So small you could hide this one on some real bugs! It's the smallest we've ever seen. With it's super sensitive mike it transmits a whisper or a room of conversation to an FM radio, tunable from 88 to 108MHz FM. With a proper antenna it transmits about 1/2 mile. The kit is made with surface mounted parts, we have already mounted these parts. You install the leaded parts. Power requirement 6 to 12v DC. Size .35" x .9"

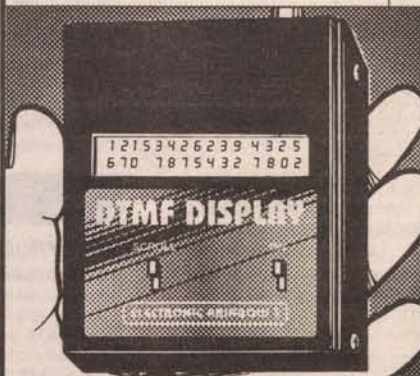
MMWM5 KIT \$34.95



STROBE LIGHT

Do you need an attention getter, warning light, or flashing light for model airplanes? Then this kit is for you. Use it as an emergency light for your auto, radio tower, even use it on your bicycle. Has a variable flash rate.

ST-1 KIT \$11.95



Press a button and learn every number dialed on your phone

Okay. Caller ID's tell you what number is calling you. But what about the calls made from your phone? Now, return from work or vacation and know the answer. The new DTMF Recorder electronically logs and saves every number dialed. This is the same high-tech magic used by detectives and government spies. Now yours. Does your wife or husband make expensive long distance calls and then deny it? Does your son or daughter call that low-life you forbade them to talk to? Now know.

- Decodes digits 0 thru 9, #, *, A, B, C, on a 2 line 16 character LCD display.
- Clicks into your phone or extension in seconds, with no special wiring or hassles, or jack it to the incoming service panel in your garage.
- Records all numbers dialed, including local numbers that don't appear on your bill.
- Records credit card numbers entered through your phone key-pad.
- Records Voice mailbox, answering machines, and modem access numbers.
- Records Cellular or repeater phone numbers heard over your phone. Even hook to a scanner, and learn scores of emergency phone numbers. Also decodes tones stored on a tape recorder. Never before has such sophisticated gear been available to the public. And not at this price. Power requirement 9v DC. SIZE: 3.5" x 4" x 1" BLACK ANODIZED ALUMINUM CABINET

DIS-1 KIT \$119⁹⁵ BUILT \$159⁹⁵

TV NOTCH FILTERS FOR CHANNELS 2 thru 22 ONLY



Our TV filters eliminate unwanted TV channels or interference that alters both sound and video with a beep beep beep. Works on cable channels 2 thru 22) only.

NOTE: All TV Filter Kits are sold for educational purposes only. You must obtain permission from your local cable company before using these filters on your cable system.

DF-222 KIT \$14.95

Please add sufficient postage First lb \$5.00 Canada \$7.00 Additional LB. Add \$1.00 US FUNDS ONLY We will accept telephone orders for Visa or Mastercard



To Order Call 317-291-7262



ELECTRONIC RAINBOW

6227 Coffman Rd. • Indianapolis, IN 46268 FAX 317-291-7269

WESTERN TEST SYSTEMS

WE BUY AND SELL

Inquiries 303-438-9662 • Fax 303-438-9685

Orders only 800-538-1493

530 Compton St., Unit #C, Broomfield, Colorado 80020

OSCILLOSCOPES & ACCESSORIES

TO 100 MHz

TEK 5440 50 MHz 4-Trace Oscilloscope System, w/(2)5A48, 5B42	\$650.00
TEK 7A22 1 MHz High CMRR Differential Amplifier	\$350.00
TEK 7B53A 100 MHz Dual Time Base	\$175.00
TEK SC502 15 MHz Dual Trace Oscilloscope, TM500 series	\$375.00

ABOVE 100 MHz

TEK 475 200 MHz Dual Trace Oscilloscope	\$850.00
TEK 485 350 MHz Dual Channel Oscilloscope	\$1,100.00
TEK 7104 1 GHz Oscilloscope, with 7A29, 7A29-04, 7B10, 7B15	\$5,000.00
TEK 7854 400 MHz Waveform Processing Oscilloscope frame	\$1,250.00
TEK 7904 500 MHz 4-slot frame	\$500.00
TEK 7904 500 MHz System, with 7A24, 7A26, 7B92A	\$1,000.00
TEK 7904 500 MHz System, with 7A24, 7A26, 7B80, 7B85	\$1,000.00
TEK 7A19 600 MHz Single Channel Amplifier	\$175.00
TEK 7A24 400 MHz Dual Trace Amplifier	\$350.00
TEK 7A26 200 MHz Dual Trace Amplifier	\$175.00
TEK 7A29 1 GHz Single Channel Amplifier	\$550.00
TEK 7B15 1 GHz Delaying Time Base	\$450.00
TEK 7B80 400 MHz Delayed Time Base	\$175.00
TEK 7B85 400 MHz Delta Delaying Time Base	\$200.00

STORAGE

TEK 7834 400 MHz Storage Oscilloscope, w/7A24, 7A26, 7B80, 7B85	\$1,250.00
TEK SC503 10 MHz Dual Trace Storage Oscilloscope, TM500 series	\$700.00

SAMPLING

TEK 7S11 Sampling Unit	\$300.00
TEK 7T11 Sampling Sweep Unit	\$750.00
TEK R7903/7S11/7T11/S-4 12 GHz Sampling Oscilloscope System	\$1,750.00
TEK S-4 14 GHz Sampling Head	\$500.00

PROBES

TEK 1101 Accessory Power Supply, for FET probes	\$250.00
TEK P6201 900 MHz 1X/10X/100X FET Probe	\$500.00
TEK P6205 750 MHz 10X FET Probe, for TDS/DSA/CSA/11000 series	\$275.00
TEK P6701-opt.01 O/E Converter, 450-1050 nm/0-1 mW; DC-700 MHz, FC conn.	\$675.00

CALIBRATION

TEK CG551AP/TM506A Oscilloscope Calibrator, with pulse head & power module	\$3,500.00
--	------------

WAVEFORM GENERATORS

FUNCTION

HP 3310A 5 MHz Function Generator	\$325.00
HP 3310B 5 MHz Function Generator, monocyclus & var. phase trigger	\$425.00
HP 3312A 13 MHz Function Generator, sweep, AM, FM	\$850.00
HP 8015A 50 MHz Dual Output Pulse Generator	\$650.00
TEK DD501 Digital Delay & Burst Gen., for function & pulse gen's	\$375.00
TEK FG502 11 MHz Function Generator, TM500 series	\$325.00
TEK FG504 40 MHz Function Generator, TM500 series	\$875.00
TEK RG501 Ramp Generator, TM500 series	\$225.00
WAVETEK 148A 20 MHz Function Generator, AM/FM/PM modulation	\$750.00
WAVETEK 188 4 MHz Sweep/Function Generator, 20Vp-p waveform generators	\$275.00

PULSE

HP 214B 10 MHz Pulse Generator, 50V/50 Ohms, auto duty cycle	\$1,950.00
HP 8005B 20 MHz Dual Output Pulse Generator	\$450.00
HP 8007B 100 MHz Pulse Generator	\$650.00
HP 8013B 50 MHz Dual Output Pulse Generator, 3.5 nS fixed Tr	\$600.00
HP 8015A-002 50 MHz Dual Output Pulse Generator, burst mode option	\$750.00
HP 8080A/81A/82A/83A 300 MHz Word Generator	\$600.00
HP 8080A/91A/92A/93A 1 GHz Single Channel Pulse Generator	\$950.00
HP 8080A/91A/93A 1 GHz Clock Generator	\$600.00
HP 8082A 250 MHz Dual Output Pulse Generator	\$1,400.00
PHILIPS PM5785B 125 MHz Dual Output Pulse Gen., burst mode, 1 nS Tr	\$1,100.00
TEK PG501 50 MHz Pulse Generator, TM500 series	\$300.00
TEK PG502 250 MHz Pulse Generator, Tr<1nS, TM500 series	\$700.00
WAVETEK 801 50 MHz Pulse Generator	\$550.00

PROGRAMMABLE

HP 3325A Synthesizer / Function Generator, 1 uHz-21 MHz	\$2,500.00
HP 3325A-002 Synth./Function Gen., 1 uHz-21 MHz, 40V out 1 uHz-1 MHz	\$2,650.00
HP 8160A 50 MHz Programmable Pulse Generator, HPIB	\$2,500.00
HP 8165A Programmable Signal Source, 1 mHz-50 MHz	\$2,600.00
TEK AWG5102 Arb. Waveform Gen., 20 MS/s, 12 bits, 50ppm synthesis <1MHz	\$1,400.00
TEK AWG5105 Arbitrary Waveform Generator, 50 MS/s, 12 bits	\$1,700.00
TEK AWG5105-opt.02 Arbitrary Waveform Generator, dual channel option	\$2,200.00
TEK PFG5505 Programmable 12 MHz Pulse/Function Generator	\$900.00

VOLTAGE & CURRENT

VOLT METERS

HP 3456A 6-1/2 Digit Voltmeter	\$850.00
SOLARTRON 7150 5-1/2 digit Multimeter, GPIB	\$450.00

CALIBRATION

FLUKE 332B/AF DC Voltage Calibrator, 0-1111V, 0-50 mA, 7 decades	\$675.00
FLUKE 343A DC Voltage Calibrator, 0-1100V, 7 decades, 20 ppm acc	\$1,375.00
FLUKE 5100B-03,05 Calibrator, DC/Wideband AC/Ohms, GPIB	\$4,750.00
FLUKE 515A Portable Calibrator, DC/AC/Ohms, line & battery power	\$1,700.00
HP 11049A AC Thermal Converter, 3V, 20 Hz-100 MHz	\$175.00
VALHALLA 2703 AC Volt. Std., 0-120V/10 Hz-100 kHz; 120-1200V/10 Hz-1 kHz	\$2,500.00

VOLTAGE SOURCES

HP 6114A Precision Dual Range Power Supply, 20V 2 A / 40 V 1 A	\$875.00
HP 6115A Precision Dual Range Power Supply, 50V 0.8A / 100V 0.4A	\$875.00

CURRENT METERS & SOURCES

DRANETZ 656A / (3)TR2019A Current Demand Analyzer, w/(3) current probes 300A max.	\$5,000.00
HP 6177C DC Current Source, to 50V, 500mA	\$600.00
HP 6181C DC Current Source, to 100V, 250 mA	\$675.00
HP 6186C DC Current Source, to 300V, 100mA	\$750.00
KEITHLEY 414A Picometer, 0.1 nA-10 mA	\$325.00
KEITHLEY 642 Electrometer	\$3,900.00
LEEDS & NORTHRUP 4360 Precision Current Shunts, 15-500 Amp	\$650.00
TEK CT-5 High Current Transformer for P6021/A6302, to 1000A	\$650.00
VALHALLA 2575A AC/DC Active Current Shunt, 20 mA-100 A, DC-10 kHz	\$1,000.00

IMPEDANCE & COMPONENT TEST

L.C.R.

BOONTON 62AD 1 MHz Inductance Meter, 2-2000 uH	\$700.00
E.S.I. 296V 4-1/2 Digit LCR Bridge, 120 Hz & 1 kHz	\$850.00
HP 4261A 3-1/2 digit LCR Meter, 120 Hz/1 kHz	\$1,100.00
HP 4262A-003,004 3-1/2 digit LCR Meter, 120 Hz/1 kHz; HPIB	\$2,000.00
HP 4271B-101/16022A 1 MHz LCR Meter, 10 pF-10 nF/1-1000 uH, HPIB, w/fixture	\$900.00
E.S.I. RS-925 9-Decade Resistor, 0.01 ohm-1.2 Megohm	\$1,600.00
E.S.I. SR1010 Resistance Transfer Standards, 1 ohm-100 K/step	\$700.00
FLUKE 5450A Programmable Resistance Standard, 2 & 4 wire	\$2,750.00
GR 1409-SERIES Standard Mica Capacitors, 0.05% accuracy	\$150.00
GR 1413 5-Decade Precision Capacitor, 0-1.1110 uF, 1 pF res.	\$1,375.00
GR 1432-N 5-Decade Resistor, to 11,111 ohms, 0.1 ohm res.	\$275.00
GR 1432-U 4-Decade Resistor, 0-111.10 ohms, 0.01 ohm resolution	\$125.00
GR 1433-X 6-Decade Resistor, to 111,111.0 ohms, 0.1 ohm res.	\$550.00
GR 1434-G 7-Decade Resistor, 0-1,111,111.0 ohms, 0.1 ohm res.	\$500.00

HI & LO RESISTANCE

GR 1666 DC Resistance Bridge, 1 micro-ohm - 100 kilohms	\$750.00
HP 4329A High Resistance Meter, 5E5-2E16 Ohms, 10-1000V test	\$1,350.00
VALHALLA 4150-ATC 4-1/2 digit Ohmmeter, 20 milliohms-2 kilohms, 4-wire	\$1,000.00

CURVETRACERS

TEK 576 Curve Tracer, with standard test fixture	\$2,350.00
TEK 577D1/177 Storage Curve Tracer, with standard test fixture	\$2,250.00
TEK 7CT1N Curve Tracer, to 0.5W, 7000 series	\$400.00

T.D.R.

TEK 1503-opt.04 Time Domain Reflectometer, 0-50,000 feet, chart recorder	\$2,000.00
--	------------

SINGLE OUTPUT

HP 6023A Autoranging Power Supply, to 20V / 30 A / 240 Watts	\$1,000.00
HP 6031A Autoranging Supply, to 20V / 120 A / 1000 W max., HPIB	\$2,000.00
HP 6038A Autoranging Supply, to 60V / 10 A / 200 W max., HPIB	\$1,600.00
HP 6201B 20V at 1.5A CV/CC Power Supply	\$200.00
HP 6207B 180V at 200 mA CV/CC Power Supply	\$300.00
HP 6228B Dual 50V at 1 A CV/CC Power Supply, tracking	\$650.00
HP 6260B-027 10V at 100A CV/CC Power Supply	\$675.00
HP 6261B-027 20V at 50 A CV/CC Power Supply	\$675.00
HP 6263B 20V at 10 A CV/CC Power Supply	\$400.00
HP 6266B 40V at 5 A CV/CC Power Supply	\$400.00
HP 6267B 40V at 10 A CV/CC Power Supply	\$550.00
HP 6268B-027 40V at 30 A CV/CC Power Supply	\$850.00
HP 6299A 100V at 750 mA CV/CC Power Supply	\$250.00
HP 6384A 4.0-5.5V at 8 A CV/CL Power Supply	\$175.00
HP 6439B 60V at 15 A CV/CC Power Supply	\$550.00
HP 6448B 600V at 1.5 A CV/CC Power Supply	\$850.00
KEITHLEY 240A HV Power Supply, 0-1200V, 0-10 mA, CV/CL	\$250.00
SORENSEN DCR 110-45T 110V at 45 A CV/CC Power Supply	\$2,200.00
SORENSEN DCR 300-BA 300V at 8 A CV/CC Power Supply, 208/230VAC line	\$950.00
SORENSEN SRL 60-8 60V at 8 A CV/CC Power Supply, low noise	\$950.00

TEK PS501-1 Power Supply, 0-20V, 2 mV res., 400 mA, TM500 series	\$175.00
--	----------

MULTIPLE OUTPUT

HP 6227B Dual 25V at 2 A CV/CC Power Supply, tracking	\$650.00
HP 6253A Dual Output 20V 3 A CV/CC Power Supply	\$500.00
HP 6255A Dual Output 40V 1.5 A CV/CC Power Supply	\$500.00
TEK PS5010 Programmable Triple Power Supply, TM5000 series	\$800.00

MISCELLANEOUS

HP 59501A HPIB Isolated DAC/Power Supply Programmer	\$175.00
HP 6824A Bipolar Power Supply/Amplifier, to 50V, 1 A	\$400.00
HP 6827A Bipolar Power Supply/Amplifier, to 100V, 500 mA	\$800.00
KEPCO BOP-100-4M 100V, 4 A Four Quadrant Bipolar Supply / Amplifier	\$1,000.00
KEPCO BOP-36-5M Bipolar Op Amp/Power Supply, to 36V, 5 A	\$550.00

TIME & FREQUENCY

UNIVERSAL COUNTERS

HP 5314A 100 MHz/100 nS Universal Counter	\$225.00
HP 5315A-001 100 MHz/100 nS Universal Counter, TCXO reference	\$650.00
HP 5316A-003 100 MHz/100 nS Universal Counter, HPIB, 1.0 GHz C-chan.	\$1,000.00
HP 5335A 200 MHz Universal / Statistical Counter	\$1,500.00
HP 5370B-001 100 MHz Univ. Time Int. Counter, 20 pS single shot, OCXO	\$2,250.00
HP E1420A-010,030VXI card 200 MHz/ 2 nS Univ. Counter, TCXO & 2.5 GHz C-ch	\$900.00
PHILIPS PM6654/056 120 MHz/ 2 nS Programmable High Res. Counter, OCXO, GPIB	\$950.00
TEK 7D15 225 MHz Universal Counter/Timer, 7000 series	\$275.00
TEK DC5004 Programmable 100 MHz/100nS Counter/Timer, TM5000 series	\$350.00
TEK DC5009 Programmable 135 MHz Univ. Counter/Timer, TM5000 series	\$600.00
TEK DC5010 350 MHz/3.125 nS Univ. Counter, TM5000 series	\$1,000.00
TEK DC503A 125 MHz Universal Counter/Timer, TM500 series	\$450.00
TEK DC509 135 MHz High Resolution Universal Counter/Timer, TM500	\$550.00
TEK DC510 350 MHz/3.125 nS Universal Counter, TM500 series	\$750.00

FREQUENCY COUNTERS

FLUKE 7220A-opt.111 1.3 GHz Communications Counter, TCXO option	\$650.00
HP 5305B/5300B-001 1.3 GHz Counter Package w/TCXO ref., high res. audio	\$450.00
HP 5340A-001,011 18 GHz Frequency Counter, OCXO reference, HPIB	\$1,900.00
HP 5340A-005,011 23 GHz Frequency Counter, HPIB	\$2,000.00
HP 5342A 18 GHz Frequency Counter	\$2,350.00
HP 5342A-001,011 18 GHz Frequency Counter, OCXO, HPIB	\$2,750.00
HP 5342A-003,011 18 GHz Freq. Counter, +22 dBm, -20 dBm dynamic range, HPIB	\$2,750.00
HP 5342A-01,04,05,11 24 GHz Frequency Counter, OCXO, DAC, and HPIB	\$3,900.00
HP 5343A-001 26.5 GHz Frequency Counter, OCXO reference	\$4,250.00
HP 5345A/5355A/5356A-06 Pulse/CW Frequency Counter, 0.4-18.0 GHz, HPIB	\$3,500.00
HP 5361A-006 20 GHz Pulsed/CW Frequency Counter, 10 Watt protection	\$6,750.00
HP 5382A 225 MHz Frequency Counter	\$200.00
SYSTRON-DONNER 6054B 24 GHz Frequency Counter	\$1,875.00
SYSTRON-DONNER 6245A-opt. 12 18 GHz Frequency Counter, OCXO option	\$1,500.00
TEK 7D14 525 MHz Frequency Counter, 7000 series	\$175.00
TEK DC504 80 MHz Frequency Counter	\$125.00

STANDARDS

HP 105A Quartz Oscillator, 0.1 / 1.0 / 5.0 MHz	\$750.00
HP 5087A-031 Distribution Amp., 0.1 / 0.5 / 0.5 MHz x 4 channels each	\$1,800.00
HP 5359A Time Synthesizer, pulse width 5 nS-160 mS, jitter <200pS	\$2,000.00

AUDIO & BASEBAND

SPECTRUM ANALYZERS

HP 3581A Wave Analyzer, 15 Hz-50 kHz	\$850.00
HP 3586C Selective Level Meter, 50 Hz-32.5 MHz, 50 & 75 ohms	\$1,200.00
HP 8556A LF Section, 20 Hz-300 kHz	\$500.00
TEK 7L5-opt.25/R7603 Spectrum Analyzer, 20 Hz-5 MHz, 10 Hz res., w/display	\$2,250.00

DISTORTION ANALYZERS

HP 334A Distortion Analyzer, 5 Hz-600 kHz, -60 dB, auto nulling	\$550.00
HP 339A Distortion Analyzer, built-in low distortion osc.	\$2,400.00
HP 8903A Audio Analyzer, 20 Hz-100 kHz; THD, SINAD, S/N	\$2,750.00
TEK DA4084 Programmable Distortion Analyzer, 0.0025% THD, w/frame	\$1,500.00

RMS VOLTMETERS

FLUKE 8920A True RMS Voltmeter, 180 uV-700V, 10 Hz-20 MHz	\$700.00
HP 3400A RMS Voltmeter, 10 Hz-10 MHz	\$250.00
HP 400FL AC Voltmeter, 100 uV-300 V f.s., 20 Hz-4 MHz	\$200.00



90 DAY WARRANTY PARTS AND LABOR • 10 DAY INSPECTION TEST EQUIPMENT WANTED CALL OR FAX LIST • OPEN ACCOUNTS



OSCILLATORS

FLUKE 6011A Synthesized Generator, 10 Hz-11 MHz, 10 Hz res.	\$1,200.00
HP 204D Oscillator, 5 Hz-1.2 MHz, 5 VRMS, 80 dB step attenuator	\$200.00
HP 209A Sine/Square Wave Generator, 4 Hz-2 MHz, 5 VRMS max.	\$225.00
HP 652A Test Oscillator, 10 Hz-10 MHz	\$300.00
ROCKLAND 5100 Synthesizer, 1 mHz-1.999999999 MHz	\$400.00
TEK SG502 Sine/Square Osc., 5 Hz-500 kHz, 70 dB step atten., TM500	\$350.00

MISCELLANEOUS

HP 3575A-002 Phase-Gain Meter, 1 Hz-13 MHz, dual display	\$900.00
HP 4437A Step Attenuator, 0-119.9 dB, DC-1 MHz, 600 ohms unbal.	\$200.00
KROHN-HITE 3202 / 3202R Dual High-Pass/Low-Pass Filter, 20 Hz-2 MHz, 24 dB/oct	\$600.00
KROHN-HITE 3342 Dual HP/LP Filter, 0.001 Hz-99.9 kHz, 48 dB/octave	\$1,100.00
TEK AM502 Differential Amplifier, 0.1 Hz-1 MHz, TM500 series	\$575.00

RF & MICROWAVE

SPECTRUM ANALYZERS

HP 11970A WR28 Harmonic Mixer, 26.5-40 GHz	\$1,100.00
HP 11970K WR42 Harmonic Mixer, 18.0-26.5 GHz	\$1,100.00
HP 11970Q WR22 Harmonic Mixer, 33-50 GHz	\$1,400.00
HP 11970U WR19 Harmonic Mixer, 40-60 GHz	\$1,400.00
HP 11971A WR28 Harmonic Mixer, 26.5-40.0 GHz, for 8569B	\$1,100.00
HP 11971K WR42 Harmonic Mixer, 18.0-26.5 GHz, for 8569B	\$1,100.00
HP 5371A Modulation Domain Analyzer, 125 mHz-500 MHz	\$5,900.00
HP 8406A Comb Generator, 1/10/100 MHz increments, to 5 GHz	\$450.00
HP 8443A Tracking Generator, for 8553B, LED display	\$700.00
HP 8444A Tracking Generator, 0.1-1300 MHz, for 8554B	\$800.00
HP 8444A-059 Tracking Generator, 0.5-1500 MHz, for 8554, 8568, etc.	\$1,500.00
HP 8445B Preselector, 1.8-18.0 GHz, for HP 8555A	\$800.00
HP 8552B IF Section	\$750.00
HP 8553B RF Section, 1 kHz-110 MHz	\$500.00
HP 8554B RF Section, 0.1-1250 MHz	\$800.00
HP 8554B/8552B/141T Spectrum Analyzer, 100 kHz-1250 MHz, 100 Hz resolution	\$2,000.00
HP 8555A RF Section, 0.01-18 GHz	\$950.00
HP 8555A/8552B/141T Spectrum Analyzer System, 10 MHz-18 GHz, 100 Hz res.	\$2,250.00
HP 8555A/8552B/8445/141 As above, w/1.8-18 GHz Preselector, opt.003 freq. display	\$3,000.00
HP 8558B/181TR Spectrum Analyzer, 0.1-1500 MHz, 1 kHz res., w/display	\$2,250.00
TEK 496P Spectrum Analyzer, 10 kHz-1.8 GHz, 30 Hz res., GPIB	\$5,500.00
TEK 7L12/7613 Spectrum An., 100 kHz-1.8 GHz, 300 Hz min. res., w/display	\$1,875.00
TEK 7L18/7603 Spectrum Analyzer, 1.5-18.0 GHz, 30 Hz res., w/display	\$3,400.00
TEK TR503 Tracking Generator, 0.1-1800 MHz, for 492/4/5/6	\$1,750.00

NETWORK ANALYZERS

HP 11590A Bias Network, 1.0-12.4 GHz, N(f)	\$375.00
HP 11590A-001 Bias Network, 1.0-18.0 GHz, APC7	\$450.00
HP 11665B Modulator, 0.15-18.0 GHz, for use with 8755/6/7	\$375.00
HP 8407A/8412A/8601A Network Analyzer, 100 kHz-110 MHz, with sweep generator	\$1,250.00
HP 85021A Directional Bridge, 0.01-18.0 GHz, APC7, for 8755/6/7	\$1,200.00
HP 85027E Directional Bridge, 10 MHz-26.5 GHz, for 8757 series	\$2,000.00
HP 85050D APC7 Calibration Kit, for 8510 series	\$1,100.00
HP 8505A-005/8503A Network An., 0.5-1300 MHz, w/S-Parameter & phase lock	\$5,000.00
HP 8755C(3)/11664A/181T Scalar Network An. w/3 detectors, 10 MHz-18 GHz & frame	\$1,750.00
HP 8756A(3)/11664A Scalar Network Analyzer, w/(3) detectors, 0.01-18 GHz	\$3,750.00
NARDA 7000A/7202/7206 Microwave Multimeter System: scalar analysis 0.1-18 GHz	\$1,950.00
WILTRON 560/3x-7S50 Scalar Network Analyzer, w/3 detectors, 0.01-18.5 GHz	\$2,000.00
WILTRON 640/G50/E(2)/7B50(2) Network An., w/1-1500 MHz source, (2) log amp, (2) det.	\$1,675.00

SIGNAL GENERATORS

FLUKE 6060A/AN Synthesized Signal Gen., 10 kHz-520 MHz, 10 Hz res, GPIB	\$2,000.00
FLUKE 6060A-488,651 Synth. Signal Gen., 0.1-1050 MHz, 10 Hz res., GPIB	\$3,200.00
FLUKE 6062A Synthesized Signal Gen., 0.1-2100 MHz, 10 Hz res., GPIB	\$8,000.00
GIGATRONICS 600/10-18, opt.06 Synthesized Source, 10-18 GHz, 1 MHz res., OCXO, GPIB	\$3,000.00
GIGATRONICS 605/0.01-8.0, opt.3 Synthesized Source, 10 MHz-8 GHz, 1 kHz res., GPIB	\$3,000.00
GIGATRONICS 875/50 Levelled Multiplier, x4, 50.0-75.0 GHz output, -3 dBm	\$3,500.00
GIGATRONICS 875/86 Levelled Multiplier, 26.5-40.0 & 50.0-75.0 GHz outputs	\$7,000.00
GIGATRONICS 910/12-18, opt.14, 16 Synthesized Source/Sweeper, 12-18 GHz, 1 Hz res., OCXO	\$3,500.00
HP 85100V Frequency Mult., 10-15 GHz in / 70-75 GHz out >0 dBm	\$4,250.00
HP 8640B Signal Generator, 0.5-512 MHz, AM, FM	\$1,500.00
HP 8640B-001,002,003 Signal Gen., 0.5-1024 MHz, AM, FM, var. audio osc.	\$2,750.00
HP 8654A Signal Generator, 10-520 MHz, calibrated AM & uncal. FM	\$625.00
HP 8656A Signal Generator, 0.1-990 MHz, AM, FM, GPIB	\$2,900.00
HP 8660C/86602B/86633B Synthesized Signal Generator, 1-1300 MHz, AM, FM	\$2,750.00

HP 8660C/86603A/86633B Synth. Sig. Gen., 1-2600 MHz, AM, FM, digital sweep	\$4,500.00
HP 8683B Signal Generator, 2.3-6.5 GHz, AM, WBFM, Pulse	\$5,000.00
HP 8684B Signal Generator, 5.4-12.5 GHz, AM, WBFM, Pulse	\$5,000.00
WILTRON 6742A Synthesizer/Sweep Generator, 18.0-26.5 & 26.5-40.0 GHz	\$9,000.00

SWEEP GENERATORS

GIGATRONICS 900/0.05-12, opt.3 Synthesized Sweep/Sig. Gen., 50 MHz-12 GHz, 1 kHz res.	\$4,500.00
HP 8350A/86290B-H08 Programmable Sweep System, 2.0-22.0 GHz, +4 dBm lvl'd	\$5,500.00
HP 8601A Generator/Sweeper, 0.1-110 MHz, +20 dBm levelled	\$500.00
HP 8620C Sweep Oscillator Frame \$550.00	
HP 8620C-011 Sweep Oscillator Frame, GPIB programmable	\$675.00
HP 86220A RF Plug-in, 10-1300 MHz, +10 dBm levelled	\$800.00
HP 86222B RF Plug-in, 10-2400 MHz, +13 dBm levelled, xtal markers	\$1,500.00
HP 86222B-002 RF Plug-in, 10-2400 MHz, +13 dBm levelled	\$1,750.00
HP 86230B RF Plug-in, 1.8-4.2 GHz, +10 dBm unlevelled	\$675.00
HP 86240A RF Plug-in, 2.0-8.4 GHz, +16 dBm levelled	\$1,000.00
HP 86240B RF Plug-in, 2.0-8.4 GHz, +13 dBm levelled	\$1,000.00
HP 86241A-001 RF Plug-in, 3.2-6.5 GHz, +8 dBm levelled	\$500.00
HP 86242D-004,008 RF Plug-in, 5.9-9.0 GHz, +10 dBm levelled	\$500.00
HP 86245A RF Plug-in, 5.9-12.4 GHz, +16 dBm levelled	\$1,100.00
HP 86250D-001 RF Plug-in, 8.0-12.4 GHz, +10 dBm levelled	\$700.00
HP 86260A RF Plug-in, 12.0-18.0 GHz, +10 dBm unlevelled	\$1,000.00
HP 86260A-H04 RF Plug-in, 10.0-15.0 GHz, +10 dBm unlevelled	\$1,100.00
HP 86290A RF Plug-in, 2.0-18.0 GHz, +7 dBm levelled	\$1,750.00
HP 86290B RF Plug-in, 2.0-18.6 GHz, +10 dBm levelled	\$2,250.00
HP 86290C RF Plug-in, 2.0-18.6 GHz, +13 dBm levelled	\$2,500.00
WAVETEK 1001A Sweep Generator, 0.5-300 MHz	\$350.00
WAVETEK 907 Sweep/Signal Generator, 7.0-11.0 GHz, 0 dBm levelled	\$1,000.00
WAVETEK 954 Signal/Sweep Generator, 3.7-7.6 GHz, +7 dBm unlevelled	\$1,750.00
WAVETEK 962 Sweep Generator, 1.0-4.0 GHz, markers, +12 dBm unlv'd	\$2,000.00
WILTRON 6619A-003 Prog. Sweep Gen., 2.0-8.0 GHz, +10 dBm levelled, GPIB	\$1,900.00
WILTRON 6637A-04,02 Sweep Gen., atten. 2.0-18.6 GHz, +14 dBm levelled, 70 dB	\$4,500.00
WILTRON 6647A-04,02 Sweep Gen., 0.01-18.6 GHz, +14 dBm levelled, 70 dB atten.	\$6,500.00

POWER METERS

BOONTON 4200-01B/-4G Power Meter w/sensor, 1 MHz-26.5 GHz, -60 to +10 dBm, GPIB	\$1,500.00
BOONTON 42B/41-4E Analog Power Meter, with 1 MHz-18 GHz sensor	\$650.00
BOONTON 42B/42A-S3 Analog Power Meter, with 1 MHz-8.4 GHz N(f) sensor	\$375.00
GENERAL MICROWAVE 476/4240A Power Meter & Sensor, 0.01-18 GHz, -35 to +10 dBm	\$375.00
HP 11683A Range Calibrator, for HP 435/6/7/8	\$750.00
HP 432A/478A Power Meter, 0.01-10 GHz, -20 to +10 dBm f.s.	\$375.00
HP 432A/8478B Power Meter, 0.01-18 GHz, -20 to +10 dBm f.s.	\$500.00
HP 432C Autoranging Digital Power Meter, 10 uW-10 mW f.s.	\$425.00
HP 435A/8481A Power Meter, 10 MHz-18 GHz, -30 to +20 dBm	\$1,000.00
HP 435A/8482H Power Meter, 0.1-4200 MHz, -15 to +34 dBm	\$1,150.00
HP 435A/8483A Power Meter, 0.1-2000 MHz, -30 to +20 dBm, 75 ohms	\$1,000.00
HP 435A/8484A Power Meter, 10 MHz-18 GHz, -70 to -20 dBm	\$1,000.00
HP 436A Digital Power Meter	\$1,200.00
HP 436A-022 Digital Power Meter, GPIB option	\$1,400.00
HP K486A/WR42 Thermistor Mount, 18.0-26.5 GHz, for 432 series	\$400.00
HP Q8486A Power Sensor, 33.0-50.0 GHz, WR22, for 435/6/7/8	\$1,500.00
HP R486A WR28 Thermistor Mount, 26.5-40.0 GHz, for 432 series	\$400.00

RF MILLIVOLTMETERS

RACAL 9303 TRMS Level Meter, 10 kHz-2 GHz, -77 to +23 dBm, GPIB	\$875.00
---	----------

AMPLIFIERS, MISCELLANEOUS

AILTECH 7616 Noise Source, 1.0-12.4 GHz, N(m), 15 dB ENR	\$375.00
AILTECH 7618E Noise Source, 10 MHz-18 GHz, SMA(m), 15 dB ENR	\$500.00
AMPLIFIER RESEARCH 1W1000 Amplifier, 30 dB gain, 1-1000 MHz, 1 Watt output	\$650.00
BOONTON 82AD FM/AM Modulation Meter, 10-1200 MHz	\$800.00
ENI 3100LA Amplifier, 55 dB, 0.25-150 MHz, 100 Watts	\$4,250.00
ENI 403LA Amplifier, 37 dB gain, 150 kHz-300 MHz, 3 Watts	\$700.00
ENI 550L Amplifier, 50 dB, 1.5-400 MHz, 50 Watts	\$3,750.00
ENI A300 Amplifier, 55 dB, 0.3-35.0 MHz, 300 Watts	\$3,500.00
HP 11720A Pulse Modulator, 2-18 GHz, >80 dB on/off ratio	\$500.00
HP 8447A-001 Dual Amplifier, 0.1-400 MHz	\$500.00
HP 8901A-001,002,010 Modulation Analyzer, 150 kHz-1300 MHz, OCXO, int. cal.	\$5,500.00
HP 8901B-001,003 Modulation Analyzer, 150 kHz-1300 MHz	\$9,000.00
HUGHES 1177H02R000 TWT Amplifier, 30 dB, 4-8 GHz, 10 Watts	\$1,750.00
M.P.D. LAB2-1020-2A Amplifier, 34 dB, 1.0-2.0 GHz, 2 Watts	\$1,000.00
M.P.D. LAB2-714-3A Amplifier, 34 dB, 0.7-1.4 GHz, 3 Watts	\$1,000.00
MARCONI TF2304 AM/FM Modulation Meter, 18-1000 MHz, FM dev. 1.5-150 kHz	\$500.00
MICROWAVE SEMI.CORP. MC5112 Noise Source, 25.5 dB ENR, 1.0-12.4 GHz, N(m), +28VDC	\$325.00

COAXIAL & WAVEGUIDE

ADAMS-RUSSELL 1538-5013 High Power Coaxial Jumper Cable, 5 ft. length, LC(m/m)	\$50.00
AMERICAN NUCLEONICS AM-432 Cavity Backed Spiral Antenna, LHC, 2-18 GHz, TNC(f) *NEW*	\$95.00

BIRD 8325-30 30 dB Attenuator, 500 Watts, DC-500 MHz	\$325.00
FXR/MICROLAB S3-02N Triple Stub Tuner, 200-1000 MHz, 100 Watts max., N(m/f)	\$90.00
GR 874-LTL Constant Impedance T-rombone Line, 0-44 cm, DC-2 GHz	\$450.00
GR 900-LB Precision Slotted Line, 0.3-8.5 GHz, 50 Ohms 0.1% tol.	\$450.00
GR 900-Q GR900 14mm Interseries Adapters	\$125.00
HP 11691D Directional Coupler, 22 dB, 2-18 GHz	\$500.00
HP 11692D Dual Directional Coupler, 22 dB, 2-18 GHz	\$900.00
HP 11742A DC Blocking Capacitor, 0.01-26.5 GHz, APC3.5(m/f)	\$135.00
HP 3330D Detector, 0.01-33.0 GHz, APC3.5(m)/SMC(f)	\$275.00
HP 775D Dual Directional Coupler, 20 dB, 450-940 MHz	\$275.00
HP 776D Dual Directional Coupler, 20 dB, 940-1900 MHz	\$275.00
HP 777D Dual Directional Coupler, 20 dB, 1.9-4.1 GHz	\$275.00
HP 778D Dual Dir.Coupler, 20 dB, 100-2000 MHz, N(m/f/l/f)	\$550.00
HP 778D-011 Dual Dir.Coupler, 20 dB, 100-2000 MHz, APC7(N/f/l/f)	\$400.00
HP 8472A Crystal Detector, 10 MHz-18 GHz, neg. pol., SMA(m)	\$150.00
HP 8497K-004 Programmable Step Atten., 0-90 dB, DC-26.5 GHz, APC3.5	\$750.00
HP K422A WR42 Flat Broadband Detector, 18.0-26.5 GHz	\$350.00
HP K532A WR42 Frequency Meter, 18.0-26.5 GHz	\$500.00
HP Q752DWR22 Directional Coupler, 20 dB, 33-50 GHz	\$650.00
HP R422A WR28 Flat Broadband Detector, 26.5-40 GHz	\$400.00
HP R532A WR28 Frequency Meter, 26.5-40.0 GHz	\$500.00
HUGHES 45342H-1110WR22 Dual Directional Coupler, 10 dB, 33-50 GHz	\$875.00
KRYTAR 202020016 Directional Del., 2-20 GHz, SMA(f/m)/SMC(f), 10 uV/uV	\$200.00
M/A-COM 3-19-300/10WR19 Directional Coupler, 10 dB, 40-60 GHz	\$450.00
MILLIWAVE S91-1777B Amplifier, 2.7 dB, 18.0-26.5 GHz, +19 dBm Po, SMA(f)	\$150.00
MINI-CIRCUITS ZHL-2000 Amplifier, 20 dB, 10-2000 MHz, +15 dBm Po, 15VDC	\$85.00
NARDA 26298 20 dB Attenuator, 150 Watts, DC-1 GHz, N(f/f)	\$200.00
NARDA 3000-SERIES Directional Couplers	\$150.00
NARDA 3022 Bi-Directional Coupler, 20 dB, 1-4 GHz	\$350.00
NARDA 3024 Bi-Directional Coupler, 20 dB, 4-8 GHz	\$300.00
NARDA 3090-SERIES Precision High Directivity Couplers	\$225.00
NARDA 369BNF High Power Termination, 175 Watts, 0.7-18 GHz, N(f)	\$325.00
NARDA 4000-SERIES SMA Miniature Directional Couplers	\$75.00
NARDA 4203-6 Directional Coupler, 6 dB, 2-18 GHz, SMA(f/f/f)	\$225.00
NARDA 4246B-10 Directional Coupler, 10 dB, 6-18 GHz, SMA(f)	\$100.00
NARDA 5070-SERIES Precision Reflectometer Couplers	\$300.00
NARDA 769-30 30 dB Attenuator, 150 Watts, DC-6 GHz, N(f/m)	\$275.00
NARDA 792FF Variable Attenuator, 0-20 dB, 2.0-12.4 GHz	\$375.00
OMNI-SPECTRA 2082-5810-02 Adj. Phase Trimmer, 8-18 GHz, 10 deg./GHz range, SMA(m/f)	\$50.00
PAMTECH KYG1014WR42 Junction Circulator, 18.0-26.5 GHz	\$250.00
PRD N233A/232 Slotted Line, 3-12 GHz, N(m/f), w/carriage & detector	\$175.00
SPACEK LABS DQ-1WR22 Flat Broadband Detector, 33-50 GHz	\$550.00
TRG V510WR15 Precision Rotary Vane Atten., 0-50 dB, 50-75 GHz	\$1,000.00
TRG V551 WR15 Frequency Meter, 50.0-75.0 GHz	\$600.00
TRG V559-10WR15 Directional Coupler, 10 dB, 50-75 GHz	\$400.00
WEINSCHEL 3200-1 Programmable Step Atten., 0-127 dB, DC-2 GHz, SMA *NEW*	\$200.00
WILTRON 60A50-opt.1 SWR Bridge, 5-2000 MHz, APC7 test port, 46 dB dir.	\$550.00
WILTRON 60NF50 SWR Bridge, 5-2000 MHz, N(f) test port, 40 dB dir.	\$475.00
WILTRON 87A50 VSWR Bridge, 2-18 GHz, 35 dB dir., APC7 test port	\$950.00
HP 5005A Signature Multimeter	\$350.00

LOGIC

HP 8170A-002 Logic Pattern Generator, 2 MB/s, address driver option	\$1,400.00
TEK 1240 Logic Analyzer, w/(36) 50 MHz channels	\$1,500.00

COMMUNICATIONS

HP 3551A Transmission Test Set	\$750.00
HP 3780A-001,101 Pattern Gen./Error Del., 16b word, 1544/6312/44736 clk.	\$1,000.00
HP 59401A HP1B Bus Analyzer	\$700.00
TEK 1410R-opt.04 NTSC Test Signal Gen. w/SPG2, TSG1, TSP1, TSG3, TSG5, TSG6	\$2,750.00
TEK 1411R-opt.04 PAL Test Gen. w/SPG12, TSG11, TSP11, TSG13, TSG15, TSG16	\$2,750.00
TEK 144 NTSC Test Signal Generator	\$675.00
TEK 147A NTSC Test Signal Generator, with noise test signal	\$800.00
TEK 520A NTSC Vectorscope	\$1,250.00

MISCELLANEOUS

HP 59307A HP1B VHF Switch	\$200.00
P.A.R. 5205-94,95,96,98 Lock-In Amp, 20 Hz-20 kHz, inl. osc., inl. log, GPIB	\$2,750.00
P.A.R. 5206 Two-Phase Lock-In Amplifier, 2 Hz-200 kHz	\$2,500.00
P.A.R. 5208-92,94,97,98 Two Phase Lock-In Amp., 5 Hz-20 kHz or 200 kHz, GPIB	\$3,250.00
TEK TM5006 5000-series 6-slot Programmable Power Module	\$600.00
TEK TM503 500-series 3-slot Power Module	\$175.00
TEK TM504 500-series 4-slot Power Module	\$175.00
TEK TM506 500-series 6-slot Power Module	\$250.00
TEK TM515 500-series 5-slot Traveller Power Module	\$275.00

New Product

Our readers are always looking for new and interesting electronic items. Showcase your NEW PRODUCTS here to help stimulate your product's success. Submit all news releases, product information, and/or photos to:

NUTS & VOLTS MAGAZINE
NEW PRODUCT EDITOR,
430 PRINCELAND CT., CORONA, CA 91719

News

LOW-COST 2.4 GHZ VIDEO/AUDIO TRANSMITTER SYSTEM



This video/audio transmitter system combines low cost, long range, and broadcast-quality FM synthesized performance. The reliable FCC approved transmitter penetrates walls and floors for an effective range of up to 300 feet. The transmitter accepts standard NTSC video and stereo audio. The receiver offers line video and stereo audio outputs, as well as modulated channel 3 VHF output.

The system offers four-channel operation, with the ability to operate all four channels simultaneously in the same area. This provides the user with tremendous flexibility for wireless security/surveillance applications. Antennas are circular polarized patch style for broadcast-quality reception.

Power requirement is 12 volts DC on both the transmitter and receiver, making battery operation an easy option. The system comes complete with DC power supplies and all necessary connecting cables.

Security/surveillance, multiple satellite reception, and robotics/toyvision are just a few of the many potential applications of this system. Complete system is available directly from Supercircuits for \$199.95.

For more information, contact:

SUPERCIRCUITS
ONE SUPERCIRCUITS PLAZA
DEPT. NV
LEANDER, TX 78641
512-260-0333 FAX: 512-260-0444

UNIVERSAL SCPC-200



The new Universal SCPC-200 Audio Receiver is the latest state-of-the-art, microprocessor-controlled audio SCPC receiver which incorporates every needed feature for high-quality reception of

all SCPC audio networks. This fully flexible receiver allows the reception of all SCPC channels on any satellite. The SCPC-200 is completely frequency and transponder agile with automatic LNB drift compensation.

Transponder, frequency, bandwidth, service name, and memory channel in use are prominently displayed on an easy-to-read LCD display.

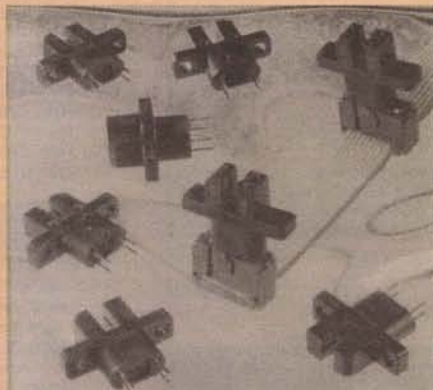
Some of the SCPC-200 features are: Easy direct frequency tuning — 50 to 90 MHz; direct transponder tuning; large memory bank — 50 channels; automatic LNB drift compensation (ADC); companding, 1:1, 2:1, 3:1 (automatic); bandwidth selection, wide or narrow; automatic tuning indicators; digital frequency lock-on (DFL); service name on LCD display; commercial digital synthesizer; and baseband 70 MHz output.

A totally new audio section produces high-quality, low distortion broadcast-quality sound at the line output or 8 ohm speaker output. The input frequency of the SCPC-200 receiver is 950 to 1450 MHz. All C-Band and Ku-Band channels are compatible with the SCPC-200. The SCPC-200 measures 12"W x 1-3/4"H x 8"D and weighs 8 lbs. Power requirements are: 110 volts AC, 60 cycles or 12 volts DC at 500 mA.

For more information, contact:

UNIVERSAL ELECTRONICS, INC.
4555 GROVES RD., STE. 12,
DEPT. NV
COLUMBUS, OH 43232-4135
614-866-4605 FAX: 614-866-1201

PRIM OPTICAL POSITION SENSOR



RADOVAN introduces the "Plug Ready Interrupter Module" (PRIM) optical position sensor.

Each sensor gives an "in position" or "position limit" indication on a TTL compatible signal line. Position is sensed when an opaque "flag" blocks a PRIMs infrared light beam.

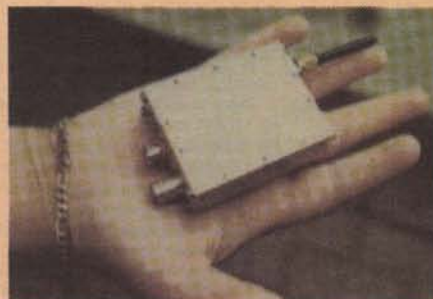
PRIMs differ from similar sensors in that they plug directly into commonly available 10-pin IDC ribbon cable connectors. That eliminates soldering, individual wire crimping, and additional circuit boards at the sensor mounting location. Wiring is further simplified by using a single 10-conductor ribbon cable for each pair of PRIMs.

The suggested retail price is \$4.95.

For more information, contact:

RADOVAN ROBOTICS
1-800-400-2654

VIDEO TX



MTX 2000, from M & G Technology, is a video transmitter using Frequency Modulation (FM) for both audio and video, which allows transmission of images (black and white or color) and sound up to 4 KM in ideal conditions. Working frequency is 1 to 2.5 GHz and RF power output is 50 mW + 1-3 dB.

The device is ready for installation of an omni-directional antenna directly mounted on the RF output connector and may be used in any situation where power is provided by a battery. Receivers and antennas of several types, filters, and amplifiers for a variety of uses are also available.

For more information, contact:

M & G TECHNOLOGY
262 CHAMBERLAYNE RD.
DEPT. NV
LONDON NW10 3LN
UNITED KINGDOM
PH/FAX 0181-451-3024

50Ω AND 75Ω RETURN LOSS BRIDGES

AVCOM introduces three new Return Loss Bridges, models RLB-1000-50, RLB-1300-50, and RLB-1000-75. The RLB-1000-50 and RLB-1300-50 are 50Ω bridges with a broad frequency coverage of 5 to 1000 MHz and 5 to 1300 MHz respectively, and excellent directivity of >45 dB. The RLB-1000-75 has an impedance of 75Ω with a directivity of >45 dB in the 5 to 600 MHz band, and slightly less machined aluminum housings, with a choice of SMA, N, and BNC connectors.

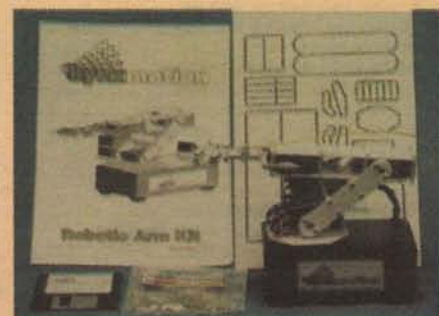
Size is 5" x 2.25" x 1", and weight 1 pound.

US domestic price RLB-1000-50 \$375.00, RLB-1300-50 \$435.00, and RLB-1000-75 \$435.00.

For more information, contact:

AVCOM OF VIRGINIA, INC.
500 SOUTHLAKE BLVD.
DEPT. NV
RICHMOND, VA 23236
804-794-2500 FAX: 804-794-8284

LYNXMOTION ROBOTIC ARM KIT



TSS introduces the Lynxmotion Robotic Arm Kit. The assembled arm has five axes with gripper and can be controlled with any serial port, even the BASIC Stamp. All axes are closed loop, so you tell it where to go and it does. The arm is very fast, accurate, and repeatable.

The arm has light power requirements and can be powered from a nine-volt and a six-volt lantern battery.

Some of the uses for this robotic arm are: teaching basic and advanced industrial robotic control programming; and light industrial manufacturing, paint, glue, or lubricant application.

The Level 1 kit is \$60.00 and uses RC servos you provide. It includes all hardware, structural components, software, and illustrated assembly manual with information on the MiniSSC Servo Controller by Scott Edwards Electronics. The Level 2 kit is \$180.00. It includes the Level 1 kit plus servos and controller. Add \$7.50 S & H USA, \$15.00 all others.

For more information, contact:

TECHNICAL SERVICE AND SOLUTIONS
104 PARTRIDGE RD.
DEPT. NV
PEKIN, IL 61554-1403
309-382-1254
www.lynxmotion.com

MOTOROLA® MINITOR II™ PAGERS

DELIVERED ON YOUR VHF FREQUENCY AND PAGING CODE



\$295

Reconditioned
Available in
3 frequency
ranges.

Monitors two frequencies, responds to your individual or group call. Other tone options available. Excellent for volunteer fire depts., rescue and first aid squads, C.A.P., E.S.D.A., Civil Defense, or Red Cross. Available in 30-50 Mhz., 148-174 mhz., and 450-512 mhz. ranges. Supplied with charger and new batteries. Reconditioned, exc cond. Limited quantities available. Warranted 90 days parts & labor. Fax orders (708)848-0230. Municipal purchase orders welcome.

(Motorola & Minitor are trademarks of Motorola Inc.)

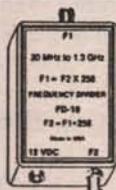
SPIRITS & MINITOR I's ALSO AVAILABLE

(708) MDM Radio, Ltd.
848-4210
7112 W Roosevelt Rd.
Oak Park, IL 60304

Write in 130 on Reader Service Card.

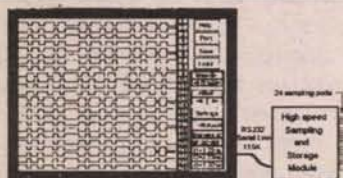
TEST EQUIPMENT cont.

FEITEK PROVIDES repair, calibration and certification on many makes of test equipment. We also have a large selection of used equipment. Send large SASE envelope for list. VISA and MasterCard accepted. Feitek Inc., 2752 Walton Road, St. Louis, MO 63114, 314-423-1770.



FREQUENCY DIVIDER FD-10. Use any inexpensive scope to look at signals up to 1.3GHz. Use any inexpensive frequency counter to measure precisely any frequency between 20MHz and 1.3GHz. Its high input sensitivity allows reading, in most cases, even without directly coupling it to the signal source. Nickel plated steel case. The price of FD-10 is \$74.95 plus \$3 S/H. Virginia residents add 4.5% tax. Send check or money order to CED, 4209 Evergreen Lane, Annandale, VA 22003. Money back guarantee. Phone: 703-354-2545.

SPECTRUM ANALYZERS TEK 492/01/02 50KHz to 21GHz portable spectrum analyzer \$6,995, TEK 496 1KHz to 1800MHz portable spectrum analyzer \$4,750, TEK 18GHz to 40GHz waveguide mixer set for Tek 492 analyzer \$1,775, TEK 7L12/7603 100KHz to 1800MHz spectrum analyzer \$1,995, HP 3582A 0.02Hz to 25.5KHz dual channel dynamic signal analyzer \$2,495, HP 3580A 5Hz to 50KHz portable spectrum analyzer \$1,495, HP 8569A 10MHz to 22GHz digital storage microwave spectrum analyzer \$6,950, HP 8569B 10MHz to 22GHz digital storage microwave spectrum analyzer \$8,995, HP 141T/8552B/ 8555A 10MHz to 18GHz spectrum analyzer \$2,195, MANY OTHER 141 SERIES MAINFRAMES, IF & RF PLUG-INS IN STOCK, **30-day warranty** & manual. Calibration available. MasterCard & Visa accepted. **CALL 1-800-435-1516, FAX 908-280-0111.**

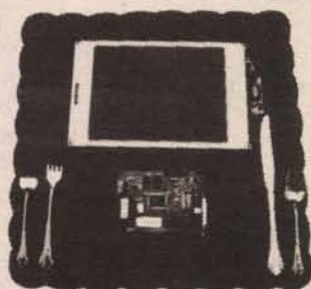


50MHz 24 CHANNEL LOGIC ANALYZER Only \$199! VGA graphics PC based interface, with RS232 link, programmable trigger, expandable to 192 channels up to 96K bytes RAM, fully assembled and tested, **ONE YEAR WARRANTY.** Get this powerful new tool at this incredibly low price! We accept MasterCard, Visa, and COD. ProBoard Circuits: 409-762-5436. 100 Market Street, Unit 16, Galveston, TX 77550.

NARDA 3000 series directional couplers \$100 ea.; Mil Taffet ZMB4U resistance bridges new in box with manual, \$60; HP 141T, \$500; HP 8555A, \$600; HP8552A, \$300; HP 141T, 8552B, 8555A, \$1,500; HP 141T, 8552B, 8554B, \$1,350; HP 8750A, \$250; HP 3580A spectrum ana. 5Hz-50KHz, \$1,500; HP 8445B, preselector, \$700; HP 8445A, \$600; HP 8443A-H03 tracking gen., \$600; HP 3550B transmission test set, \$400; GR 916AL RF bridge, \$350; GR 874D50 adjustable stubs, \$50 ea.; HP 3586C, selective level meter, \$1,500; HLI 3701 communications test set, \$400; Hughes 1406 amplifier 500MHz-1GHz 5 watts out, \$300; HP 580A D/A converter, \$150; HP 8620A, sweeper frame, \$300; HP 8620C, \$500; HP 86240A sweeper plug-in 2-8.4 GHz, \$750; noise comm. NC6101 noise gen. 10Hz-20KHz 20mW, \$200; HP 4800A Vector Zmeter, \$500. A-Comm Electronics, 7198 S. Quince St., Englewood, CO 80112. 303-290-8012, Fax 303-290-8133.

AFFORDABLE HP power sensor repair! Most 8481As repaired for \$210 or less. We also handle 478As and many others. Call or fax for more information. Willamette RF, Inc., 503-754-7226, FAX 503-753-4629.

Flat Panels Served Here



House Specialty - Monochrome LCD Kit \$249

Le Earth LCD Restaurant Menu

Appetizers (Controllers for PC ISA Bus)	
Earth LCD/M Monochrome LCD Controller	\$149
EarthVision/ISA Color LCD Controller	\$299
Entrées (Include LCD, ISA Controller, Cable & Backlight Inverter)	
Monochrome 9.4"	\$249
Color Single Scan 8.2"	\$450
Color Dual Scan 9.4"	\$749
Color 9.4 TFT	\$995
Ala Carte (LCD Only)	
Mono 9.4" LCD	\$95
Color 8.2" Single Scan	\$125
Color 9.4 Dual Scan	\$399



Computer Technologies

"The Flat Panel Solutions Company"

P.O. Box 7089 - Laguna Niguel - California - 92607
Phone: (714) 448-9368 - Fax: (714) 448-9316 - BBS: (714) 448-8093

Write in 208 on Reader Service Card.

CABLE T.V. EQUIPMENT

Super quantity discounts on all test modules

Lowest Prices!

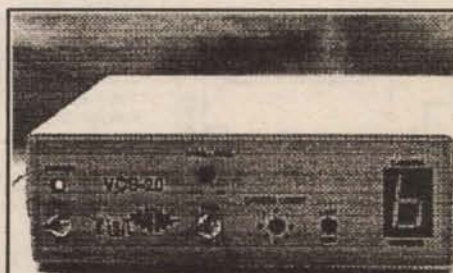
Call us with your lowest price, and we will BEAT IT!

CFS ELECTRONICS
(800) 995-1749

DEALERS WELCOME!

We accept: MC, VISA, AMEX, and C.O.D.'s

Write in 169 on Reader Service Card.



VCS-20
Surveillance
Camera
Switcher &
Sequencer.

8 sources to one output. Adjustable cycle (Dwell) time from 2 to 75 seconds per position. Number of active sources may be set from 1 to 8 using front panel selector. Large LED display indicates camera position currently displayed. RUN/HOLD control allows user to stop indefinitely on any input. Lamp test button for checking display segments. Operates from 9VDC AC adapter. Optional Audio Switch add on available. **\$195.00**

To place an order or request detailed catalog of this and other products & services call our **TOLL FREE number**. MasterCard/VISA accepted.



COMMUNICATIONS
SYSTEMS
LABORATORIES
1-800-529-9483

Multi-Media Control Systems For Home And Industry.
Custom Design And Manufacturing.
Call us for solutions to your requirements.

Write in 53 on Reader Service Card.

March 1996 43

Voice Recording and Playback: Look — No Tape!

by Ronald Reis
and
Jimmy Te

No tape, no CDs, no complex A/D or D/A converters, and no microprocessor. It's all done with a unique, readily available, inexpensive Direct Analog Storage Technology (DAST) integrated circuit from Information Storage Devices, found at Radio Shack and other distributors.

With the most popular DAST chip — the ISD1020A — up to 20 seconds of sound (voice, music, dogs barking, etc.) can be recorded simply by speaking into an inexpensive microphone. The chip stores up to 128,000 analog sample-and-hold bits into an on-board EEPROM. After data has been stored, the memory is maintained without power. Playback, through an eight-ohm speaker, is accomplished with the flick of a switch.

The ISD1020A chip requires just a few external components and in a power down application runs forever on four AA cells.

Applications abound: fridge-box message center, portable voice notepad, medicine chest alert, talking toys, doorbell announcer — the list is endless.

How the ISD1020A Works

The ISD1020A is an amazing chip. In one 28-pin DIP package, there is contained a microphone preamp, an automatic gain control (AGC), anti-aliasing and smoothing filters, a storage array, a speaker driver, a control interface, and an internal precision reference clock (Figure 1). There are, as mentioned above, no analog-to-digital or digital-to-analog circuits.

Using an analog-sampled data system, the ISD1020A takes each sample, temporarily stores it in a sample-and-hold circuit, and eventually records it into a single Electrically Erasable Programmable Read Only Memory (EEPROM) containing 128,000 cells. With a sample rate of 6.4 KHz, a waveform element is "grabbed" every 156.25 microseconds ($T = 1/f; = 1/6.4 \text{ KHz}; = 156.25 \text{ uS}$). Thus, with 128,000 cells available, 20 seconds of sound can be recorded ($156.25 \text{ uS} \times 128,000 = 20$

seconds).

The ISD1020A can be made to begin recording or playing at any point within a 20-second period. When a record or play cycle is initiated by the chip enable (CE) pin, the IC reads the address pins' states and operation starts at the indicated address. More on this later.

The IC also has a special Operation Mode. When pins 9 and 10 are both tied high, several special features, including automatic looping and sequence message generation, can be activated. I'll discuss the Operation Mode shortly.

Actually, the ISD1020A is one of two chips in the ISD1000A series, the other being the ISD1016A. "Our" chip will record for 20 seconds, that's what the 20 in the part number means. The ISD1016A will record for 16 seconds.

The ISD Voice Record and Playback Family

Besides the ISD1000A series, Information Storage Devices offers other voice record and playback integrated circuits. The ISD1200 series, with the ISD1210 and ISD1212 chips, record and playback for 10- and 12-second durations, respectively.

There is the ISD1400 series (identical to the ISD1000A series except it has an automatic power down mode), consisting of the ISD1416 and ISD1420, having 16- and 20-second delays, respectively. And the ISD2500 three-chip series, made up of the ISD2560, ISD2575, and ISD2590, can record and playback

Everybody's
talking about a
new way of
yakking — boy, will
it blow your mind!

sound for 60, 75, and 90 seconds, as indicated in the last two digits of their part number.

For more information on the entire line of ISD Voice Recording and Playback ICs, you might want to obtain the company's 1996 Data Book (Part #2001195B001). Contact ISD at 2045 Hamilton Avenue, San Jose, CA 95125; Tel: (408) 369-2400, Fax: (408) 369-2422.

The ISD1020A, Pin-for-Pin

In Figure 2, we see the pinouts for the ISD1020A. In Figure 3 is a detailed description of each pin function. Here are the highlights:

*Ground Inputs (VSSA, VSSD)

The ground inputs are at pins 12 (VSSD) and 13 (VSSA). Separate analog and digital ground busses are used.

*Voltage Inputs (VCCA, VCCD)

The voltage inputs are at pins 28 (VCCD) and 16 (VCCA). To minimize noise, the analog and digital circuits in the ISD100A series devices use separate power busses.

*Power Down Input (PD)

The chip should be placed in the power down mode (pin 24) when not recording or playing back.

*Chip Enable Input (CE)

When the active-low CE pin (23) is taken low, all playback and record operations are enabled.

*Playback/Record Input (P/R)

When this pin (27) is brought low, the chip is in the record mode. When it is brought high, the IC will play back.

*End-of-Message (EOM)

At the end of each recorded message, a non-volatile marker is automatically inserted (pin 25). It remains there until the message is recorded over. During playback, the EOM output pulses low for 16 milliseconds.

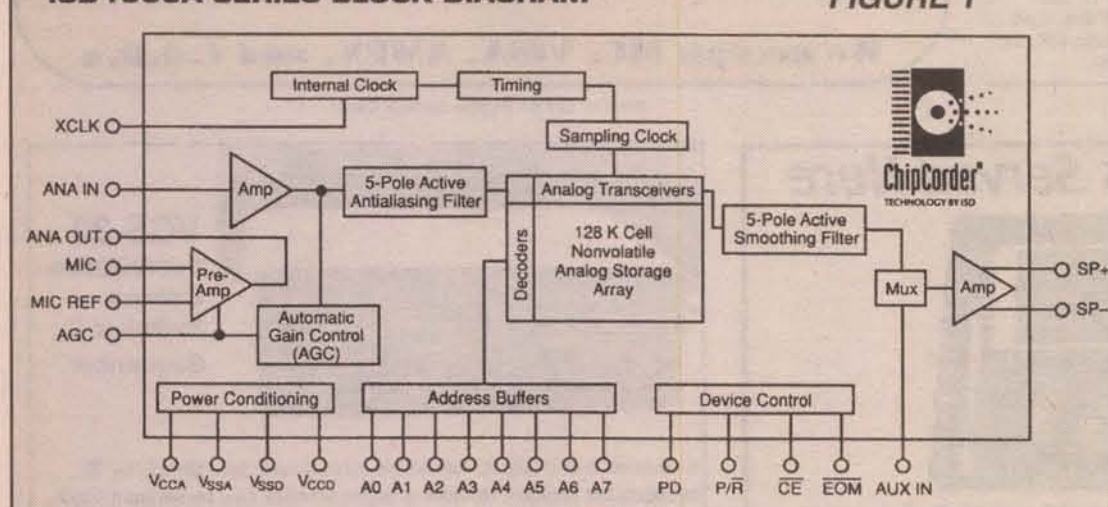
*Address/Mode Inputs (AX/MX)

The address/mode inputs (pins 1, 2, 3, 4, 5, 6, 9, and 10) provide two functions: 1. Message address (A6 or A7 = low); and 2. Operation mode options (A6 and A7 = high).

We'll look at other ISD1020A pins as we progress with circuit descrip-

ISD1000A SERIES BLOCK DIAGRAM

FIGURE 1



ISD1000A SERIES
PINOUTS

M0/A0	1	28	VCCD
M1/A1	2	27	P/R
M2/A2	3	26	XCLK
M3/A3	4	25	EOM
M4/A4	5	24	PD
M5/A5	6	23	CE
NC	7	22	NC
NC	8	21	ANA OUT
A6	9	20	ANA IN
A7	10	19	AGC
AUX IN	11	18	MIC REF
VSSD	12	17	MIC
VSSA	13	16	VCCA
SP+	14	15	SP-

DIP/SOIC

FIGURE 2

OPERATIONAL MODES TABLE

TABLE 1

Control Mode	Function	Typical Use	Jointly Compatible*
M0	Message cueing	Fast-forward through messages	M4, M5
M1	Delete EOM markers	Position EOM marker at the end of the last message	M3, M4, M5
M2	Cascading	Adding devices to extend message	
M3	Looping	Continuous playback from Address 0	M1, M5
M4	Consecutive addressing	Record/Play multiple consecutive messages	M0, M1, M5
M5	CE level-activated	Allow message pausing	M0, M1, M3, M4

NOTE: An asterisk (*) indicates additional operational modes which can be used simultaneously with the given mode.

PIN DESCRIPTION

FIGURE 3

Pin No.	Name	Function
1, 2, 3, 4, 5, 6, 9, 10	A0 — A7	Defines the starting address for messages or sets the device to an operation mode.
7, 8, 22	NC	No connection. Do not connect to these pins.
11	AUX In	When the device is in the play mode and not playing a message, the AUX input drives the speaker output. This lets other circuits use the speaker driver. This input is also used in cascading applications.
12, 13	VSSD, VSSA	Analog and digital grounds.
14, 15	SP+, SP-	These pins connect directly to a 16-ohm speaker without coupling capacitors. You can connect an 8-ohm speaker, but there will be distortion. Do not use a less than 8-ohm speaker. You can use either pin single-ended, with capacitive coupling. If either pin is not used, leave it disconnected. Never short the pins or tie either to ground. When operating, the speaker pins are at about 1.5 volts. When not operating or recording, the speaker outputs are pulled to ground. Do not parallel the speaker outputs with other signals. Doing so could damage this device or the other signal source.
16, 28	VCCD, VCCA	Analog and digital power supplies. The device uses separate power buses for the analog and digital sections to minimize noise.
17	Mic	The microphone preamp can amplify 1- to 20-millivolt signals. This preamp has a 10 K ohm input impedance and a 24 dB maximum gain.
18	Mic Ref.	This is the inverting input to the microphone preamp. This provides a noise-cancelling or common-mode rejection input to the device. Normally, connect a capacitor from this pin to analog ground. This capacitor should have the same value as the input coupling capacitor.
19	AGC	Connect a 470 K ohm resistor and a 4.7 μ F capacitor from this pin to ground. These components set the attack and release time constants for the Automatic Gain Control circuit in the microphone preamp.
20	Ana In	This pin goes to an input amp that drives the internal storage array.
21	Ana Out	This pin is the direct output of the Mic preamp.
23	CE	This pin starts play and controls record operations. CE is active low.
24	PD	This pin controls the power-down mode and resets the memory after the device records or plays to the end (overflow). The device powers down when this pin is high.
25	EOM	This pin outputs a 16-millisecond wide low pulse during play to indicate a message is finished. It outputs a constant low to indicate memory full. Note: When the device records or plays to the end, you must pulse PD high and then return it low before you can begin additional record or play operations.
26	XCLK	Normally connect to ground. This enables the internal clock. You can drive this input with an external 819.1 KHz TTL-level clock.
27	P/R	The state of this pin when CE falls determines whether the device is in record (low) or play (high) mode.

Note: This book uses *low* and *high* for logic states of parts of the circuit. An input low is 0 volts or ground. An input high is the VCC supply — usually 5 volts. If a circuit output is low or high, the voltage is within a few tenths of a volt of these levels.

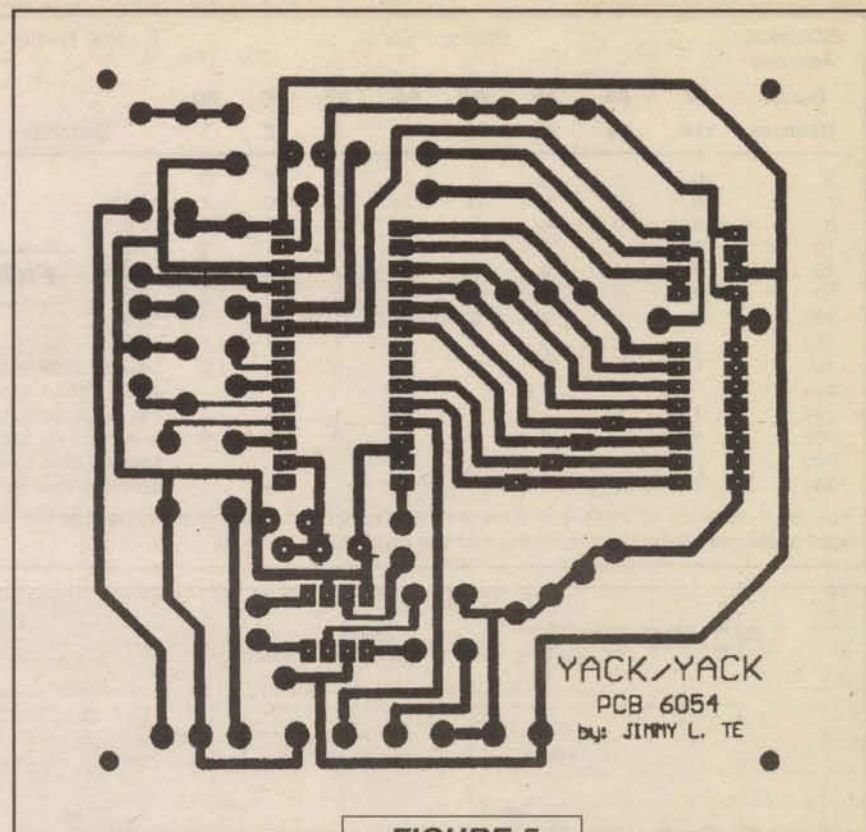
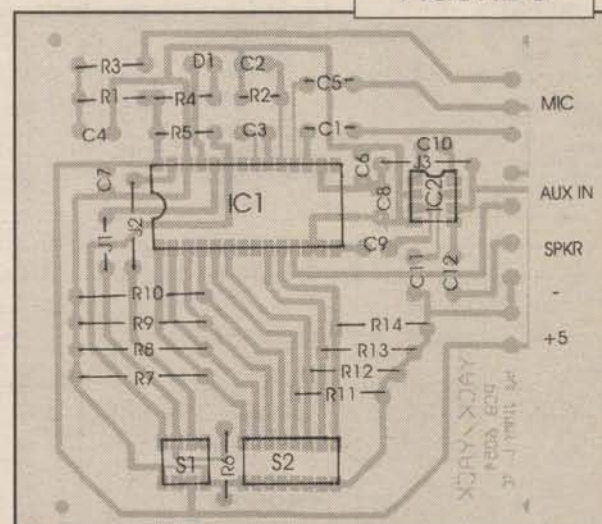


FIGURE 5



down, playback, and record functions.

- An LED detects an end-of-message condition. It remains off during record or play and turns on when a message ends.

- A three-terminal Electret microphone is used for recording. It is available at Radio Shack (Part No. 270-092).

- While a power amplifier is not mandatory, we've included one to boost audio

output.

- The only off-board components are the microphone, speaker, and power supply. For optimum sound, the speaker should be baffled, that is, placed in an enclosure. Four 1-1/2-volt AA cells can be used as a power source.

Assembly of the project is straightforward. Just be sure to place the right component in the right location and, if polarized, in the right direction. Also, follow standard, professional soldering techniques. When assembly is completed, check closely for solder bridges.

Once you've assembled the Yack/Yack project, and double-checked component placement and solder integrity, apply power and follow these steps to record and play a message:

To record a message:

1. Load the start address with the eight-section DIP switches. For simplicity, set all switches closed. This begins recording at the start of the ISD1020A's memory space.

2. Set S3 (P/R) on the four-section DIP switch to off, or open. (Play is deactivated.)

3. Set S4 (P/R) on the four-section DIP switch to on, or closed. (Record is activated.)

- The eight active-high address lines — A0-A7 — are connected to an eight-section DIP switch, with eight 47 Kohm resistors used to pull respective pins high.

- A four-section DIP switch is used to activate the chip enable, power

tions. Let's now turn to an examination of a basic record/playback circuit.

The Yack/Yack: A Simple Record/Play Project

The schematic for a simple

record/play project — the Yack/Yack — with an audio power amplifier added is shown in Figure 4. The PC board layout for the circuit is presented in Figure 5A, with the assembly drawing in Figure 5B. Note the following with regard to the circuit:

FIGURE 4

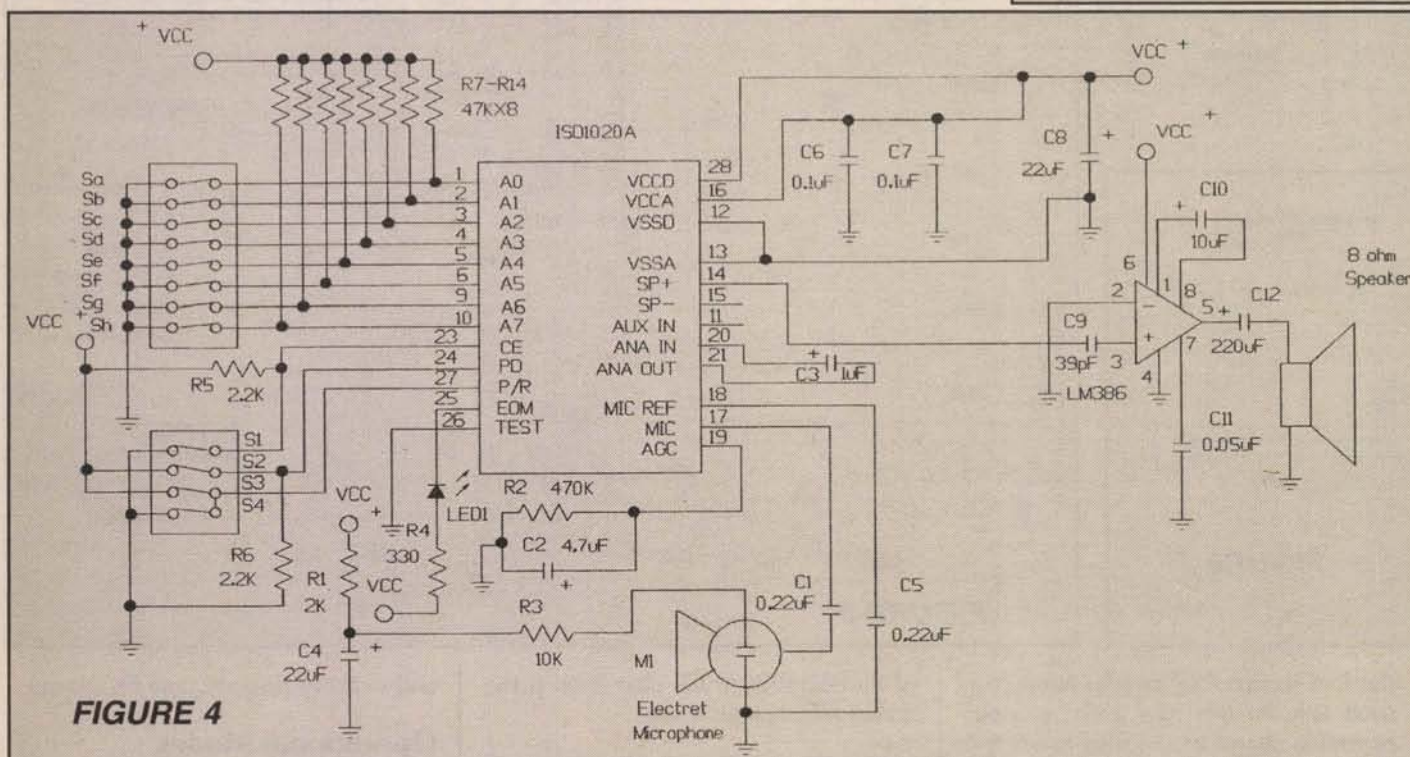


FIGURE 6

FIGURE 9

VCC

1 2 3 4 5 6 9 10

A0 A1 A2 A3 A4 A5 A6 A7

23 24 27 25 26

CE PD P/R EOM XCLK

VCCD VCCA VSSD VSSA SP+ SP- AUX IN ANA IN ANA OUT MIC REF MIC AGC

28 16 12 13 14 15 11 20 21 18 17 19

VCC

LS1

16 OHM SPEAKER

COPYRIGHT ISD CORP
1994

91-10-007

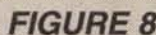
NOTE: CIRCUIT LOOPS BEGINNING AT 000 AND THE MESSAGE CAN'T REACH 160 (END)

zero second point, and you did not wish to activate any of the chip's Operational Mode features, you could forget about using the eight-section DIP switch altogether. Just install eight jumpers instead.

However, by setting the ISD1020A's address lines, 160 different starting points can be obtained, 125 mS apart ($160/20 \text{ sec.} = 0.125 \text{ seconds}$). You can now access multiple messages.

In Figure 6, we see a selection of address settings for the ISD1020A. The address-input decimal values are as follows: A0=1, A1=2, A2=4, A3=8, A4=16, A5=32, A6=64, and A7=128.

To start the record or playback function at a desired time, obtain the decimal value by dividing the time in seconds by 0.125. For example, if you want your record/playback to begin at the 10-second point in memory, divide 10 by 0.125. The result is 80. Thus, switches Se and Sq would be set open.



The ISD1020A is designed with several built-in operational modes, many of which you may want to take advantage of. There is, for instance, message cueing (M0), which allows you to skip through messages. We have delete EOM markers (M1) that allow the

sequential recording of messages to be combined into a single message. And there is message looping (M3), where you'll have a continuous playback from address 0. The complete listing of operational modes is shown in Table 1.

The operational modes are selected with the address pins. When the two Most Significant Bits (MSBs) are high (A6=1, A7=1), the remaining address signals are interpreted as mode bits, not as address bits. Hence, operational modes and direct addressing are not compatible and cannot be used simultaneously.

A Simple Play-Only Circuit

You could stop here, that is, build the Yack/Yack project, fool around with various operating modes, and have fun recording and playing back messages. However, the ISD1020A cries out to be experimented with. If you're so inclined, grab your solderless circuit board, an ISD1020A, and a few support components. It's time to look at alternate circuits.

In Figure 7, we see a simple play-only circuit. After using your Yack/Yack project to make a recording, place the ISD1020A in a solderless circuit board and wire it as shown. Only two additional components are required: an on-off SPST switch and a speaker.

To play a message, set the switch to the +5-volt position. The ISD1020A plays the entire contents one time then stops. Because CE is tied low, the set

end-of message bits are ignored. Momentarily changing the switch to open then back to +5 volts makes the ISD1020A play again.

What can you do with such a play only circuit? How about embedding it within an object you would pick up to admire. Perhaps a picture frame? Imagine grandma's thrill the next time she visits and stops to admire her grandson's portrait on the mantle. As she picks it up, closing a hidden switch, little Johnny's prerecorded voice gushes forth with: "I love you grandma, you're the best." You get the "picture."

Automatic Power Down Applications

Many applications for sound recording and reproduction, where battery power is necessary, require minimum power consumption. A circuit that achieves automatic power down in a record and play application is shown in Figure 8. Let's see how it works.

The cross-coupled latch, consisting of a 4093 Schmitt Trigger Quad two-input NAND package (U2A and U2B), works to control the PD and CE pins for the play mode.

Circuitry for the record mode consists of U2C and U2D plus several support components.

To start the record cycle, S2 supplies the ground to the microphone circuit and takes the input to U2D low. The Schmitt Trigger action of U2 debounces the logic inputs to the

ISD1020A. The output of U2C takes the P/R signal low and provides a low to the PD and CE pins through D2. Resistor R6 and capacitor C7 provide the CE set-up time between P/R going low and the beginning of the record cycle. Diodes D4 and D2 perform an OR function for the play and record operations. Diode D3 ensures that the cross-coupled gates cannot be set during a record operation.

Playback Looping

If you want a message to repeat over and over again, automatically, the simple circuit in Figure 9 will do the trick. It uses the Operation Mode to accomplish playback looping as long as the message starts at Address 0 (the beginning of the memory) and does not require the full 20 seconds of analog storage.

A message is first recorded into an ISD1020A using the Yack/Yack project, with all address bits tied low. Next, connect the circuit in Figure 9. Note that Address bits A6 and A7 are tied high to enable the Operational Mode. Bit A3 is also tied high to enable Continuous Repeat. With PD low, P/R high, and CE held low, the beginning message in the ISD1020A will repeat.

A One-Minute Cascade Circuit

You can cascade several ISD1020As to increase a system's

capacity.

A circuit to create a one-minute message is shown in Figure 10. With this configuration, a message is stored across chip boundaries in a manner transparent to the user. Changing from record to play resets the MSP to the beginning of the first message in the series. The next play proceeds under control of CE. The circuit operates exactly like that for a single device.

Believe it or not, we've only looked at a few select applications for sound recording and playback. To examine the complete range of chips in the ISD line of products, try obtaining a copy of the data book mentioned at the beginning of this article.

Now, have fun yakking away and recording every word. **NV**

PARTS LIST	
R1	2 kohm
R2	470 kohm
R3	10 kohm
R4	330 ohm
R5, R6	2.2 kohm
R7-R14	47 kohm
C1, C5	22 uF
C2	4.7 uF
C3	1 uF
C4, C8	22 uF
C6, C7	0.1 uF
C9	39 pF
C10	10 uF
C11	0.05 uF
C12	220 uF
IC1	ISD1000A
IC2	LM386
S1	4-section DIP switch
S2	8-section DIP switch
MIC	Electret microphone (Radio Shack 270-092)
SPKR	8-ohm speaker
6V	power supply

TEST EQUIPMENT cont.

TECHNICIAN TEST Equipment repair calibration ISO certified NIST traceable lab, best lab and people to work with high standards of quality workmanship 10 years experience required on specifically HP Tek equipment. Send resume to **INSTRUMENT REPAIR**, 2100 W. 6th Ave., Broomfield, CO 80020. 303-469-5375.

MICRODYNE 1110 series telemetry receivers all bands. FM and PM demodulators, spectrum display units, IF filters. 805-934-2058.

HP 8505A network analyzer \$1,995, HP 5328A 500MHz universal frequency counter with option 30, which includes option H99, 010, 011, and 030. Option 010 is high stability time base. This equipment has been reconditioned and calibrated with 90-day warranty. \$498. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

WANTED! TEST equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424.

WANTED: MODULATION ANALYZERS: HP 8901, HP 8902, also HP 5328A, WJ8617B HP1B interface boards. W8CV, 810-620-0853.

TEKTRONIX 454 as-is \$100, HP 8441A \$100, HP 3300A \$100, HP 331A \$100. Wanted: Original manuals for HP 5371A, HP 5060A, HP 5061A and B, HP 10830A, HP 8330A, HP 8334A, Frequency Electronics cesium and rubidium standard manuals. Wanted cesium and rubidium standards, any condition. Also selling and repairing standards. Free estimates. Corby Dawson, 805-736-0288.

TEST EQUIPMENT Sale: Tektronix 2235 100MHz dual channel scope, \$900; PowerMate Lectraload II electronic load, 0-100V 0-300A, \$450; Tektronix 7603, \$250; ACDC EL750, programmable electronic load, \$400; Acme PS2L1000 electronic load, \$450; HP 3466A, with battery pack, \$300; HP 3435A, \$150; HP 3456A, \$850; GR1601 VHF bridge, \$200; GR1650A, RCL bridge, \$250. A-Comm Electronics, 303-290-8012.

WAVEFORM GENERATOR, 1Hz to 20MHz installs in PC ISA slot, DOS and Windows control software. Free information. AstroSoft, 15006 La Mesa St., Sylmar, CA 91342.

SYNTAX

The State of the Art in Cable Solutions

CABLE TV DECODERS

J-replaces STEALTH, TNT, TVT, etc.

No tuning, flashing, flickering or troubles

**Quality Control
100% Testing
Assures
No Returns**

QTY.	PRICE
50	= \$35 ea.
100	= \$30 ea.
500	= \$28 ea.

Price includes shipping

WHOLESALE ONLY-NO SINGLES: **1-800-676-8131** (9 AM to 5 PM EST)

Cellular Extensions

from

"THE CELLULAR EXPERTS"

Motorola 3 Watt Bag Phone from \$199

Nec P120 12oz. Portable \$299

Motorola PT 550 10oz. "Flip" Phone from \$299

Others available, buy new from us, or send us your phone.
Get a second or third phone with no additional monthly charges!
Motorola, NEC, Panasonic, Audiovox and many others.

Fax Back Hotline For 24hr info. call from your FAX
(714) 581-7460 or call 1-800-457-4556 9 to 5 PST
CA Grapevine. Worldwide inquiries welcome.

Write In 129 on Reader Service Card.

10 METER BLOWOUT!



Uniden HR2510

\$189.99
cod

Emperor 5010 (mobile unit) **\$219.99** cod

RCI 2950 (mobile unit) **\$199.99** cod

RCI 2970 (mobile unit) **\$349.99** cod

RCI 2990 (base unit) **\$599.99** cod

EAGLE 2000 (base unit) **\$399.99** cod

Emperor 5011 (power supply) **\$99.99** cod

TS-5010

&

TS-5011

Combination

\$319.98

cod

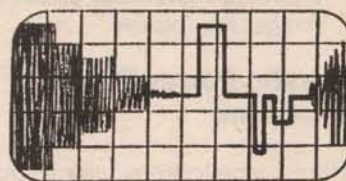
Call For A **FREE** Catalog
1-800-626-6343

www.iglou.com/copper

COPPER ELECTRONICS

Write In 168 on Reader Service Card.

TEKTRONIX 7000 SERIES Plug-ins: 7CT1N curve tracer \$395. 7D20 digital storage \$750. 7B53A 100MHz time base \$190. 7B85, 7B80 400MHz time bases \$195, \$165. 7B92A 500MHz time base \$295. 7B15, 7B10 1000MHz time bases \$550, \$475. 7L13 spectrum analyzer, 1KHz-1800MHz, 30Hz RBW \$1,750. 7L5/L3 spectrum analyzer, 20Hz-5MHz \$1,400; with tracking generator \$1,900. 7S12, S-6, S-52 time domain reflectometer, can display distance to .1" per division \$1,500. 7S14 1GHz sampler \$675. Mainframes: 7633 100MHz storage \$435. 7904 or R7903 500MHz \$435. Excellent condition! Other plug-ins, mainframes, package discounts available. All with warranty. Pepper Systems, 214-353-0257.



FREQUENCY COUNTERS: HP 5381A \$95, HP 5383A \$245, HP 5328A \$245, HP 5328A/096 \$495, HP 5328A/098 \$545. **METERS:** HP 3490A \$395, Rycom 6040 \$995, HP 3406A \$795. **SCOPES:** Tek 453 \$245, Tek 455 & battery \$495, Tek 465M \$495, Tek 475 \$595, HP 1725A \$595, HP 1741A \$595. **GENERATORS:** HP 204C \$125, HP 652 \$295, HP 8005B \$495. HP 8660A mainframe \$495, Wavetek 3000-200 \$745. **ANALYZERS:** HP 334A \$395, Rycom 6040 \$995, Gary N6ZD, 408-385-0301, FAX 408-385-0261. GARYN6ZD@AOL.COM

POOR MAN'S Spectrum Analyzer/Monitor Receiver Kit. 2 to 1,700 MHz. Basic kit only \$78. Now available with switched resolution filters, tracking generator and direct digital frequency readout. Works with ANY scope or IBM compatible computer. Send stamped envelope for details. Science Workshop, Box 310B, Bethpage, NY 11714.

SIEMENS W2008 level oscillator \$365/offer. Dexis, 612-944-7670.

IFR 500/500A WANTED. Must be in excellent physical and operating condition. Will pay \$2,500++. Ask for Spence Porter, Communications Specialists, 1-800-854-0547.

REPAIR AND CALIBRATION Accucal Services provides low cost repair and calibration of electronic test equipment from HP, Tek, Fluke, Biddle, etc. Call or fax for a quote today. Phone, 609-678-8691; FAX 609-678-3466. Accucal Services, Pennsville, NJ 08070.

SCOPE BOOSTER Kit, increase the input frequency of your scope to 170MHz. No internal connections required. Free brochure. Creative Technology, 206 Gilbert Ave., Winsted, CT 06098.

FREQUENCY COUNTERS HP 5342A 10Hz to 18GHz microwave counter \$2,495, HP 5328A/030 512MHz universal counter \$495, HP 5328A 100MHz universal counter \$295, HP 5316A 100MHz universal counter \$495, HP 5315B 100MHz universal counter \$495, HP 5314A 100MHz universal counter \$295, HP 5340A 18GHz microwave counter \$1,495, HP 5359A high resolution time synthesizer \$1,995, SYSTRON DONNER 6351A 100MHz universal counter \$395, SYSTRON DONNER 6054C 18GHz microwave counter \$1,495, FLUKE 1910A 125MHz multifunction counter \$275, FLUKE 1900A 80MHz multifunction counter \$195, Fluke 7260A DC to 125MHz universal counter/timer \$650, RACAL-DANA 9916 520MHz universal counter \$375, HP 5255A 3GHz to 12.4GHz Frequency converter plug-in \$175, HP 5257A 50MHz to 18GHz transfer oscillator plug-in \$100. **30-day warranty** & manual, calibration available. MasterCard & Visa accepted. **CALL 1-800-435-1516, FAX 908-280-0111.**

WAVETEK MOD. 21, 11MHz stabilizer function generator, \$750 OBO. 916-272-1950.

WANTED: HEWLETT PACKARD 8902As, 8903Bs, 8116A, AND 8350B UNITS, ANY QUANTITY. WE PAY CASH WITHIN 24 HOURS OF EVALUATION. CALL 601-868-6596 OR FAX INFO TO 601-868-0133.

HP 3330B Auto synthesizer in good condition \$250. 415-244-9254.

KEITHLY 487 Picoammeter \$2,395. Dexis, 612-944-7670.

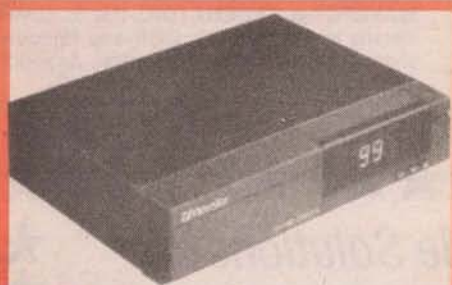
TEKTRONIX TEST EQUIPMENT: Tek 106, squarewave gen., \$150; 109 pulse gen., \$100; Tek 1474 NTSC color gen., \$200; Tek 1502 TDR, \$800; Tek 191 constant amp sig. gen., \$200; Tek 1L20 spec. ana. plug, \$200; Tek 603A storage scope, \$250; Tek 606B XY display, \$250; Tek 607A XY storage, \$250; Tek 634 video monitor, \$250; Tek 7603 3 slot frame, \$250; Tek 6834, \$450; Tek 7904, \$350; Tek 7A11, \$200; 7A12, \$100, 7A13, \$200; 7A14, \$150; 7A18, \$75; 7A22, \$200; 7A24, \$200; 7A26, \$150; 7B10, \$150; 7B15, \$150; 7B50, \$100; 7B50A, \$100; 7B53A, \$150; 7B70, \$100; 7B71, \$125; 7B80, \$125; 7B85, \$150; 7B92A, \$150; 7M13, \$150; TM506, \$200; TM504, \$150; TM504, \$150, C30A camera, \$100; C30B \$150, Tek SC503 10MHz storage scope, \$250; DM501A, DVM \$100; DM502, \$100; PS501-2, \$100; Tek SI-5010 programmable scanner, \$150; TM503 3 slot frame \$125; TM515, \$200; Tek 434 25MHz storage, \$350; Tek 7623A, 7A26, 7A26, 7B53A, \$600. A-Comm Electronics, 303-290-8012.

MANUALS FOR SALE TECH SYSTEMS HAS OVER 3,000 OPERATORS AND SERVICE MANUALS FOR SALE. HP, TEK, FLUKE, GEN RAD, SYSTRON DONNER, ETC., ETC., ETC. MASTERCARD AND VISA ACCEPTED. CALL SUSAN WITH YOUR REQUIREMENTS AT 1-800-435-1516 OR FAX 908-280-0111.

HP 7132A \$250; HP 3495A \$100; HP 7004B \$250; HP 5420A \$500; HP 1630G \$1,000; HP 1631D \$1,500. Tech 7904A \$225; 7704A \$150; 7844 \$300; 7603 \$75; 7633 \$200; 4612A \$50; DC505A \$200; 7B92A \$300; 7A26 \$175; 7D01 \$50; TM506 \$125; P-6452 \$400. Autex Systems 503 WFM ana. \$250; 502SMPLG scope \$200. GR-1340 \$150. Wavetek 175 arb. WFM gen. \$750; 164 30MHz swp. gen. \$150. VPU 200 \$150. Climet Part. Ana. \$200. Kulicoff Soffa 2 484-8, both \$750. Spectrol Dyn. balancer SD119C \$750. Power supplies Kepco Ate 6-100M \$50. Partial list, will fax or mail complete list. Phone 1-800-328-7845 or 507-754-7611, Steve.

HP 3779B multiplexer analyzer in good condition \$700. 415-244-9254.

Viewstar



Model 2020-85 CHANNEL CONVERTER w/REMOTE
includes these great features and many more

Last Channel Recall Parental Control 1 10
Favorite Channel Scan Sleep Timer 64.95 55.95

Model 2520-w/vol control
1 10 20+
79.95 77.95 75.95

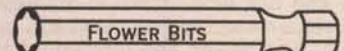
Panasonic Converter

TZPC145

Includes: Last Channel Recall
Parental Control
Favorite Channel Scan
Sleep Timer

1 10 20+
73.95 69.95 67.95

NEW Jerrold HEX Drive



1/4" x 2" 1-9 12.50
1/4" x 4" 1-9 14.50

These security bits are compatible with all the following companies:

Pioneer 6300 round bit (tri-notch) 13.95
Pioneer round bit (no notches) 13.95

NEW Jerrold Flower-head Security Screwdriver-7" 17.50

NEW Hex-drive Hand Ratchet Fits all our TORX and Hex bits 5.95

Steel-shank magnetic screwdriver for Hex-insert bits 5.35

KIT

(also shown: 2" and 3" bits) only

19.95

Includes Screwdriver or Ratchet and any four 1" TORX bits

VISION SPECIALTIES

MasterCard VISA
CUSTOMER SERVICE
(909) 483-3848
ORDERS ONLY
(800) 233-8431
Pacific time
Rancho Cucamonga, CA

Many Other Items
VOLUME PRICING
California Sales Tax 7.34%
Prices Subject to Change
We don't Sell
Descramblers

REMOTE CONTROLS

Remotes compatible with these companies:

Jerrold 1-9 10-25
400/450/550 7.65 6.40
CFT-2000 8.75 7.65

Scientific Atlanta
075/175 7.65 6.40
475 Volume Control 8.10 6.90
8600 On-screen Display 8.10 6.90

Zenith
RC-1000 8.35 7.15

Prices for all of the following: 8.75 7.65

Panasonic
PA 120
PA 140
Hamlin
RCPX, CRP-5,
CRP-6, CRP-7
Oak
Sigma Series
Pioneer
BR-82
Tocom
All Models



TORX BITS

NEW SIZES

	1"	2"	3"
Tocom T-7	3.95	4.95	na
Zenith T10	3.95	4.95	na
Zenith T15	3.95	4.95	5.95
Scientific Atlanta T20	3.95	4.95	5.95



TEST EQUIPMENT SALES



HP 3325A Synth./Func. Generator\$1995
 HP 1980B DIGITIZING O'SCOPE
 (w/ 4 ch. & digital storage)....\$1095
 TEK 465 100 MHz SCOPE
 (includes cal & manual).....\$475
 B&K 3300 5 MHz PULSE GENERATOR\$125
 HP 4342A Q METER
 (includes manual).....\$1395

KROHN-HITE 6880 Distortion Analyzer\$650
 FLUKE 5100B-03-05 CALIBRATOR\$5695
 FLUKE 5440A DC CALIBRATOR\$2695
 LAMBDA LPT-7202-FM POWER SUPPLY
 (triple output)\$395
 KEITHLEY 224 CURRENT SOURCE\$1150

CUSTOMER SATISFACTION OUR #1 PRIORITY

WE BUY SURPLUS
EQUIPMENT

PHONE (603) 434-2544
FAX (603) 425-2945

M/C & VISA
ACCEPTED

P.O. Box 986 Londonderry, NH 03053

Write in 90 on Reader Service Card.

HIPPOTRONICS HD306B hipot tester, output 0-1.2 KV and 0-6.0 KV. Excellent condition. Unit comes complete with leads and certificate of calibration. 90-day warranty. \$550. Coppes Electronics, 520-432-1229.

MARCONI MODEL 2955/2957, test equipment. Looks & works like new. SN: 119507-209. For use with 2-way, cellular and transmitters. New price: \$13,500. Sell price: \$3,950. Hecht Communications, PO Box 56377, Jacksonville, FL 32241. 904-731-9000.

OSCILLOSCOPE TEK 7854 W/KEYBOARD 400MHz digitizing scope mainframe \$1,495, TEK 7904 400MHz scope mainframe \$775, TEK 7704A 250MHz scope mainframe \$395, TEK 7623A 100MHz storage scope mainframe \$595, TEK 7A18 75MHz dual channel amplifier \$100, TEK 7A26 200MHz dual channel amplifier \$150, TEK 7A19 600MHz amplifier \$175, TEK 7A42 350MHz 4-channel logic triggered amplifier \$775, TEK 7B92A 500MHz time base \$295, TEK 7B10 1GHz delayed time base \$295, TEK 7B53A 100MHz time base \$150, TEK 7A13 differential comparator/amplifier \$175, TEK 7D15 225MHz counter/timer \$150. WE HAVE OVER 500 7000 SERIES MAINFRAMES AND PLUG-INS IN STOCK. IF YOU DON'T SEE IT LISTED IN THIS AD, CALL FOR PRICES AND AVAILABILITY. WE ALSO OFFER PACKAGE PRICES ON COMPLETE SYSTEMS. ALL SCOPES ARE NIST CALIBRATED AND COME WITH A 30-DAY WARRANTY & MANUALS. MasterCard & Visa accepted. CALL 1-800-435-1516, FAX 908-280-0111.

WANTED: TREMETRICS Model 527E frequency difference meter. Call Bill Scolnik, 1-800-634-7036 or FAX 1-800-788-5005.

X-Y RECORDERS HP 7035B \$375, HP 7045A \$490, HP 9872A w/HPIB \$450. Mint. PMI 1044 for use with PMI scalar network analyzers \$250. Tested and guaranteed. 516-487-9797 Alan.

HP 86260A RF plug-in \$500, checked out; HP 8553B RF plug-in \$200; HP 423B crystal detector \$125; Heath 2240 digital LC Bridge \$200, Gould CL-810231-01 thermal recorder 8-channel \$200. Ty Miller, Southcoast Surplus, 714-830-9170; FAX 714-454-9841.



THIS LOW circuit loading SCOPE PROBE produces a 60dB SPECTRUM ANALYZER display on your inexpensive scope. Excellent EMI/compliance tool. Request Technical Tips for line conduction, field strength, and current probe. 255 Spectrum Probe 30KHz to 2.5MHz \$279. 107 Probe 1 to 100 MHz \$249 (\$279 extra shielding). Accessory Current Adapters: IA5 \$19, IA7 \$29. SMITH DESIGN, 215-661-9107, 207 E. Prospect Ave., N. Wales, PA 19454.



sales co.

1-800-325-9465

FAX: 818-796-4875

2176 E. Colorado Blvd., Pasadena, CA 91107
Mailing Address: P.O. Box 5356, Pasadena, CA 91117-9988



BUY & SELL

Since 1947

POWER SUPPLIES

DC POWER SUPPLY

SWITCHING SYSTEMS INTERNATIONAL #SQV402-1444-1. Four Output - 5 VDC @ 50 amps. Aux. 1 - 24 VDC @ 10 amps. Aux. 2 - 24 VDC @ 5 amps. Aux. 3 - 24 VDC @ 5 amps. Aux. 2 & 3 can be series to produce 48 VDC @ 5 amps.

Stock #PS9404 \$99.50 each
10 for \$750.00



SWITCHING POWER SUPPLY

LAMBDA #LUS-8A-12. 12 VDC 1.3 amps.

Stock #PS93514 \$20.00 each
10 for \$175.00

LINEAR POWER SUPPLY

POWER ONE #HB28-1-A. 28 VDC @ 1 amp.

Stock #PS9400 \$20.00 each
10 for \$175.00

DC TO DC CONVERTER

INTRONICS #S1635-1. Input: 30 to 60 VDC. Output: 5 V @ 4 amps ± 15 V @ 150 mA.

Stock #PS9405 \$20.00 each
10 for \$150.00



±15 VDC POWER SUPPLY

BECKMAN, #MPS-60. Input 120 VAC 60 Hz @ 1 amp. Dual adjustable outputs 0 to ±15 VDC @ 0-2 amps. Resolution 10 mV and 100 mA. Accuracy ±20 mV and 100 mA. Has digital display for voltage and current. Dim.: 12" wide x 4 1/4" high x 13 1/4" deep. Weight 16 lbs. New, with manual.

Stock #PS9410 \$195.00

TEST EQUIPMENT

HEWLETT PACKARD

#140T. Spectrum Analyzer.
Mainframe \$500.00
#8555A. Spectrum Analyzer.
RF Plug-in \$1,000.00
#204C. Oscillator \$125.00
#333A. Distortion Analyzer \$695.00
#432C. Power Meter \$250.00
#3330B. Automatic Synthesizer. \$650.00
#8614B. Signal Generator.
0.8-2.4. GC \$695.00
#216A. Pulse Generator \$295.00
#8445B. Automatic Preset Selector.. \$495.00
#8057. Noise Generator \$295.00
See our catalog for more models in stock.

SOLID STATE SCOPE

HP OSCILLOSCOPE

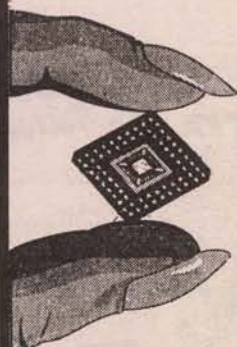
#180A. 100 MHz bandwidth. Accepts standard 1800 series plug-ins.
Stock #OS8901 \$395.00

CALL OR WRITE FOR OUR FREE 128 PAGE CATALOG!

Write in 51 on Reader Service Card.

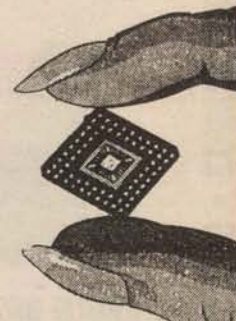
WE BUY EXCESS ELECTRONIC INVENTORIES

Obsolete or Overstocked ICs, Damaged or Overstocked PC Boards, Hard Disk Drives, Anything Electronic . . .



WE PULL ICs FROM PRINTED CIRCUIT BOARDS

- ★ We have "IN HOUSE PULLING" facilities!
- ★ We BUY both socketed and soldered parts!
- ★ We BUY PC Boards for IC value!
- ★ WE BUY PC Boards for precious metal value!
- ★ WE OFFER "Certificate of Destruction."



Guaranteed quick response to all inquiries. . .
If you have any surplus Electronic Inventory
that you would like to

turn into



call!



Worldwide
distribution

SEMICONDUCTOR
(818) 349-4495 • (818) 349-6562

Write in 52 on Reader Service Card.

ABC ELECTRONICS

(612)332-2378 FAX (612)332-8481

WE BUY TEST EQUIPMENT AND
ELECTRONIC COMPONENTS.

HP 1725A 275 MHz OSCILLOSCOPE \$300.00
TEK 453 50 MHz OSCILLOSCOPE \$250.00
TEK 475 200 MHz OSCILLOSCOPE \$500.00
TEK 485 350 MHz OSCILLOSCOPE \$600.00
(485 IS ONLY GUARANTEED TO BE FUNCTIONAL)
TEK 7104 1GHZ O-SCOPE \$2750.00
(7104 INCLUDES 7A29, 7A29, 7B10, 7B15)
TEK 7704A 250 MHz O-SCOPE FRAME \$200.00
AVEX SCOPE PROBE 100MHZ X1/X10 NEW \$35.00
HP 8601 110MHZ SWEEP/SIGNAL GENERATOR \$350.00
FLUKE 5205A POWER AMPLIFIER \$2500.00
HP 8012A PULSE GENERATOR \$400.00
TEK J16/16503 LIGHT METER \$300.00
TEK 2246 100MHZ 4CH. O-SCOPE \$1500.00
TEK 7L13 1KHz-1.8GHz SPEC. ANLZ. \$2000.00
TEK 475A 250MHZ O-SCOPE \$600.00
HP 1630D LOGIC ANALYZER \$500.00
LEADER LBO516 100MHZ O-SCOPE \$350.00
HP 141T/8553B/8552B SPEC. ANLZ. \$1500.00
GENRAD 1657 RLC BRIDGE \$750.00
GENRAD 1658 RLC BRIDGE \$900.00
TEK 7B53 100 MHz TIME BASE \$75.00
TEK 7B80 400 MHz TIME BASE \$100.00
TEK 7B85 400 MHz TIME BASE \$125.00
TEK 7B92 500 MHz TIME BASE \$125.00

TEK 7854 400MHZ STORAGE O-SCOPE FRAME \$500.00
TEK 7844 400MHZ O-SCOPE FRAME \$400.00
TEK 7834 400MHZ STORAGE O-SCOPE FRAME \$400.00
TEK 7633 100MHZ STORAGE O-SCOPE FRAME \$300.00
TEK 7623 100MHZ STORAGE O-SCOPE FRAME \$300.00
TEK 7403 60 MHz O-SCOPE FRAME \$150.00
TEK 7603 100 MHz O-SCOPE FRAME \$150.00
FLUKE 8520A 5.5 DIGIT MULTIMETER \$250.00
TEK 465B 100MHZ O-SCOPE \$450.00
FLUKE 37 3.5 DIG DMM \$100.00
BECKMAN PPS-100 30VDC 3.5 AMP P-SUPPLY \$350.00
RACAL-DANA 1991 160MHZ COUNTER IEEE \$500.00
TEK 2235 100MHZ O-SCOPE \$750.00
TEK 465B 100MHZ O-SCOPE \$450.00
TEK DAS 9100 W/PROBES \$1200.00
HP 8405A VECTOR VOLT METER \$100.00
HP 1651A LOGIC ANALYZER \$1500.00
HP 3453A 3.5 DIGIT MULTIMETER \$100.00
HP 141T/8554B/8552B SPEC. ANLZ. \$1500.00
HP 8016A WORD GENERATOR \$300.00
RACAL DANA UNIVERSAL COUNTER \$500.00
TEK 7A26 200 MHz DUAL TRACE PLUG IN \$75.00
TEK 7A24 400 MHz DUAL TRACE PLUG IN \$200.00
TEK 7A19 600 MHz SINGLE TRACE PLUG IN \$150.00
TEK 7D15 UNIVERSAL TIMER COUNTER \$100.00

30 DAY WARRANTY ON ALL EQUIPMENT EXCEPT TEK 485
OFFERS LIMITED TO QUANTITIES ON HAND.

PLEASECALL

FOR SHIPPING COST. WE ACCEPT VISA AND
MASTERCARD.

MN. RESIDENTS PLEASE ADD 7% SALES TAX.

ABC ELECTRONICS 315 7TH AVE. N. MPLS MN. 55401

Write in 167 on Reader Service Card.

MISCELLANEOUS TEST EQUIPMENT HP 432A power meter w/cable \$175, HP 435A power meter w/cable \$375, HP 400EL AC voltmeter \$125 NIST CALIBRATED, HP 400FL AC voltmeter \$125 NIST CALIBRATED, HP 3466A autoranging DMM \$295 NIST CALIBRATED, HP 3400A RMS voltmeter \$175 NIST CALIBRATED, FLUKE 8012A DMM \$250 NIST CALIBRATED, BOONTON 92A RF millivoltmeter w/probe \$295, BOONTON 82AD modulation meter \$895, SAUNDERS 150C crystal test oscillator/IEEE \$1,695. 30-day warranty & manual. Visa & MasterCard accepted. CALL 1-800-435-1516, FAX 908-280-0111.

VERMONT TEST & LAB EQUIPMENT. A bit of everything. Audio, aviation, chromatography, inspection, microfiche, microwave, radio, spectrophotometry, etc. Where do we mail our list? Andrew Smith, AMSL 802-254-9459, FAX 802-257-4862.

TEST EQUIPMENT: HP 3488A switch/control unit \$975. HP 59401A HP1B bus analyzer \$475. GR 1689 LCR meter \$2,300. Fluke 540B transfer standard \$1,000. Tek 1105 inverter \$175. Tek 390AD digitizer \$600. HP 8015A 50MHz pulse generator \$395. HP 8016A 50MHz ECL/TTL word generator \$395. HP 5370A time interval counter (oven time base) \$1,800. HP 7580B drafting plotter (sizes A-D) \$1,375. Excellent condition! All with warranty. Pepper Systems, 214-353-0257.

TEST EQUIPMENT FOR SALE/WANTED: RF, microwave, video and fiber optic, cable TV, broadcast TV, satellite and related industries. Wavetek, Tektronix, Hewlett Packard and other manufacturers. Spectrum analyzers, signal level meters, sweep systems, TDRs, OTDRs, and much more. PTL Cable Service. Phone 407-747-3647, FAX 407-575-4635.



2.4 GHZ VIDEO/AUDIO TRANSMITTER/RECEIVER

4 Channels, 300 Foot Range,
Cables and AC Adapter Included

\$175

DBS 14" Antenna and Downconverter \$250

MMDS, ITFS, OFS Systems \$150

ALJON TECHNOLOGIES, INC.

3892 Del Amo Blvd. #703, Torrance, CA 90503

Tel **(310) 793-1788**

Major Credit Cards Accepted

Write in 128 on Reader Service Card.

WAVETEK 3000-200 with reverse power protection option. This unit "went out" on me. I will sell for \$300. Clean, attractive with factory manual. U fix, U ship. Tom, 334-365-0127.

ATOMIC INSTRUMENT Company 204-B linear amplifier, \$80. 605-757-6424.

NETWORK & SPECTRUM ANALYZERS, ETC.: Tek 7L13 1KHz-1800MHz, 39Hz RBW \$1,750. Audio Precision System One SYS-22G dual generator/analyzer \$4,700. Tek 7L5/L3 20Hz-5MHz \$1,400; with tracking generator \$1,900. HP 3580A 5Hz-50KHz, 1Hz RBW adaptive sweep, tracking generator: \$890 (mech), \$1,390 (LED). Tek TR 503 tracking generator \$1,100. Anritsu MS420B powerful spectrum, network analyzer/tracking generator, 10Hz-30MHz, 3Hz RBW \$2,600. HP 8505A/005 1300MHz network analyzer 100dB dynamic range, with manuals, phase-lock, 8501A (8502A, 8503A available) \$3,700. HP 8559A 10MHz-21GHz, 1KHz RBW \$3,300. Excellent condition, warranty. Pepper Systems, 214-353-0257.

TEST EQUIPMENT EIP model 101A Yig tuned spectrum analyzer 700MHz to 15.7GHz dispersion 0 to 15GHz with manual \$1,200; WAVETEK model 2001 sweep gen. .01 to 1400MHz with manual \$450; TEK 130 LC meter with fixtures and manual \$200. 715-675-3370.

FREE! THE ETC. Catalog of manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

TEKTRONIX 465-M o'scope with cover, probe \$395. Other equipment available with SASE. Call RT Burton and Company, 706-796-2219, FAX 706-796-0056. PO Box 6087, Augusta, GA 30916.

WANTED: TEST equipment for hospital and laboratory equipment. Leakage, wattage, pressure, flow rate, etc. Specialty Equipment Resources, PO Box 879, Goshen, CA 93227. Phone/FAX 209-734-7709.



JONES MODEL 1600-1 instrument tachometer centrifugal mechanical tach measures RPM scale 0-500 RPM, coupling shaft 1/8" accessories, various size rubber tipped drive couplings, case new \$35. Also, Jones Model 1600-7 RPM scale 0-11,000 RPM w/accessories new \$35. Davilyn Corp., 818-787-3334, 1-800-235-6222, FAX 818-787-4732.

CUSHMAN CE5 with 302/303 \$650, CE3A with 302/303 \$450, both with manuals. **WANTED DEAD OR ALIVE** Cushman 314 module and 141T 8554 module. 414-452-3803 evenings or jdufon@excel.net

SURPLUS ELECTRONIC test equipment for sale for pennies on the dollar. Request list. Phone 908-722-6157. Fax 908-722-6391.

CONVERTERS • CONVERTERS • CONVERTERS

CONVERTERS • CONVERTERS • CONVERTERS

CONVERTERS • CONVERTERS • CONVERTERS

CONVERTERS • CONVERTERS • CONVERTERS



JERROLD DRX-3-105
61 Channel, Fine Tuning
Factory Refurbished
Single: \$45.00
5+: \$39.00
10+: \$35.00



PANASONIC
550 MHz • HRC Switch
Parental Lock-out • More!
Single: \$75
5+: \$69.00
10+ \$65.00



UNIVERSAL REMOTES!
REPLACEMENT REMOTES!
\$5.00 & up



REGAL CR-83
83 Channel • Parental Lock-Out
More! Factory Refurbished
Single: \$55.00
5+: \$49.00
10+: \$45.00

**Ask about Customer
Referral Incentives**

Remote, Batteries & Coax Cable Always Included
WE DO NOT SELL DECODERS, TEST DEVICES, CHIPS, ETC!

CALL NOW!

1-800-322-9690



BRIGAR ELECTRONICS

7-9 ALICE ST.
BINGHAMTON, NY 13904



PHONE (607) 723-3111
FAX (607) 723-5202
E-MAIL BRIGAR2@aol.com

CREDIT CARD DISCOUNT
\$ 0.00 - \$99.99 NET
\$100.00 - 249.99 Less 10%
\$250.00 - 499.99 Less 15%
\$500.00 - 999.99 Less 20%

\$30.00 MIN ORDER

SEND FOR FREE CATALOGUE

SERVING: *INDUSTRY *SCHOOLS *HOBBYISTS *EXPERIMENTERS *CONSUMERS

OPEN: MONDAY THRU FRIDAY 7:30 AM TO 4:30 PM, SATURDAY 7:30 AM TO NOON

Answering Machine Code-a-phone #1750
FEATURES: *One touch play back *Ring delay(1,2,3,4) *Auto out going message check *Variable out going message *Built in cassette *No call disconnect *Voice-activated recording *Led message display *Fast forward,rewind,pause & rr (Removed from service good cond.)
Original COST \$179.00
COMMERCIAL Quality

SALE PRICE \$7.95



ULTRASONIC LIGHT SWITCH
Motion Sensing Automatic SWITCH
Replaces existing wall switch - operates from 120vac power. 750W max. load. Great for home alarm systems or controlling lights & small appliances. Adjustable time & sensitivity, on-off switch - led trip indicator - Color: White
Size: 5"w x 5"h x 1-3/8"d - Energy Savings 30 to 60%

PRICE \$12.95 EA.
5 FOR \$60.00



HI VOLUME FAN - 115 VAC
NIDEC-TORIN TA600S
.250/.20 AMP 3200 RPM
IMPEDANCE PROTECTED.
50/60 HZ - MODEL # A32060-10
SIZE: 6.25"DIA. X 1 1/2"THICK
BRAND NEW FACTORY BOXED.

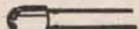
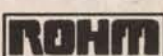
PRICE... \$14.95 EA.
5 for \$60.00



3M STATIC CONTROL
FLOOR & TABLE MATS
8200 series - 2 ft. X 5 ft mat
3 LAYER CONSTRUCTION
COLOR BROWN
SPECIAL ... \$25.00



ROHM # SLR47VR3F
RED LED T 1-3/4
5MM DIFFUSED LED
100 PCS. @ 10¢ EA.
500 PCS. @ 7¢ EA.
1000 PCS. @ 5¢ EA.



STEPPING MOTOR - AIRPAX
100 STEPS/REV. * 3.6 Step angle
*bi polar wound-
bi-directional *2 PH
*Torque 75 oz/in
*SIZE: 1.5"SQ X 1 3/8"t
*3.2VDC *6.8AMP \$2.25



HE381

Power Products
Linear power supply module
Input: 115VAC 50/60 271 ma
OUTPUT: 5VDC 5000 ma
PRICE .. \$20.00



CMOS EPROM #NMC27C256Q-200
28 PIN DIP 256K (32 X 8)
SPEED 200 NS
LIST PRICE \$5.00

BRIGAR
PRICE.. \$1.75



CURTIS INDUSTRIES #F1200AA20
10 AMP 250VAC - 20AMP 115VAC
50/60HZ-size: 2"w x 2 1/2"l x 1 1/2"h
.250" QUICK Connect terminals D.
Brand new
factory Boxed
BRIGAR SALE
PRICE \$3.50



TELEDYNE SOLID STATE RELAY
PART # 615-8500

CONTROL VOLTS: 3-32VDC
RATED: 10AMP @ 250VAC
50/60HZ -
OPTO ISOLATED - SPST
Connection: screw or
quick Connects
PRICE... 1 - 99 PCS. 100 PCS - UP
\$ 10.95 \$ 9.95



MEMOREX AUDIO PATCH CABLE
6 FT. RCA MALE TO RCA MALE
BLACK CABLE MOLDED ENDS.-
MONO CABLE - BLISTER PACKED
FOR DISPLAY. SALE PRICE.. \$1.00



3 COND 14 AWG
* LENGTH: 4 FEET * O.D. .375"
* COLOR: GREY * TYPE: SJT
* CSA APPROVED
* strip and untinned ends.
Standard 3 prong molded plug.
PRICE \$1.25 EA.



ASTROSYN MINIANGLE Stepper Motor
#23LQ-C202-01H

*144 STEPS *30 oz in. Hold torque
*BI POLAR - 2 PHASE
*4 WIRE *1.9 Vdc/PHASE
* 0.75 AMP/PHASE
*WEIGHT 3/4 LB
* SIZE: 1-1/2"H X 2-1/4"DIA
*Mounting plate: 2-1/4"sq.
SPECIAL SALE.. \$12.95



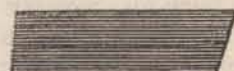
CONTROL TRANSFORMER #522013

* PRIMARY: 120VAC
* Secondary 12V C.T. @ 4 AMP
SIZE: 3 3/4"W X 3 1/8"H X
3 3/4"DEEP
BASE MOUNT
WEIGHT: 7 1/4 LBS

PRICE. \$7.95



GRAY FLAT RIBBON CABLE
#YP3301 50 COND. 28 AWG (7/36)
.010" Thick pvc insul. 300V - 105°C
awm style 2651 mil-c-49055/1-13a
ul approved .050 Cond. Spacing
black polarity stripe. Will terminate to
any standard idc connector -2.5"Wide
Brand New Factory Boxed.
ORIGINAL PRICE \$360.00
300 FT. REEL ... \$69.00



ANALOG PANEL METERS #40-013857
MULTIMETER - MFG: PHASTRON
ANALOG METER MOVEMENT 50 MICRO
AMPD.C. FULL SCALE. LARGE 4.5"DIA
3.5" Viewing AREA. ZERO ADJUSTMENT
KNOB. WHITE FACE SCALES: IN
GREEN, BLK, AND
BLUE LETTERS.
THREE AC & THREE
DC VOLT SCALES
0 - 2.5, 5 AND 10. ONE
RESISTANCE SCALE
FROM 0 TO INFINITY.
INCLUDES MOUNTING
HARDWARE BRAND
NEW FACTORY BOXED.
GREAT PRICE..... \$6.95



Snapit Alert - Great light activated intrusion
alarm
Put in any Dark place and when light hits it
an alarm sounds. Size 3"W x 3"H x 1 1/4"t
Operates on a single
9volt battery (not included)
velcro fastening strip can
be used to mount on
any surface.
Use for: gun rack, brief case
medicine cabinet, drawers,
desk drawer etc.
\$3.95 ea....



DELTROL SOLINOID
56676-61 24VDC
19.8W 30.6 Ohm
Int. Duty - Style D11
Quick connect terminals
Size: 1-3/4"H x 1-1/8"W x 1"D
Lift & Stroke: 1/16" @ 55 oz.
3/4" @ 6 oz.
PRICE.. \$1.45 EA.



MACHINED PIN DIP IC SOCKETS

GOLD PLATED CONTACTS - .100" CENTER TO
CENTER PIN SPACING.
LOW PROFILE
lead length .188"
body height .125"



PIN	PART#	MFG	WIDTH	PACKAGED
16	1031601446	EMC	.3"	25/TUBE 32¢ ea.
16	516-AG19D	AUGAT	.3"	25/TUBE 32¢ ea.
18	1018AG11D	AUGAT	.3"	25/TUBE 36¢ ea.
20	Som-320-G	Preci	.3"	18/TUBE 40¢ ea.
24	824-AG48D	AUGAT	.3"	20/TUBE 48¢ ea.
24	524-AG67D	AUGAT	.4"	18/TUBE 48¢ ea.

* SOLD IN FULL TUBES ONLY

Machined Pin IC Socket with Decoupling Capacitor.

Low Profile ic socket with chip capacitor. A more
noise free alternative to sockets with leaded
capacitors. GOLD plated pins - Body is Glass
Epoxy Laminate.

SOLD IN FULL
TUBES ONLY



PIN	PART #	Mfg	WIDTH	Packed	Price
16	4431608446-1	EMC	.3"	25/TUBE	40¢
24	4462408446-1	EMC	.6"	25/TUBE	56¢

NEUTRIX #NC3FC IN LINE XLR Socket

HVY. DUTY AUDIO POWER CONNECTOR

5A @ 250VAC

HOUSING: DIE CAST-NICKLE PLATE

Contacts: copper

Insulator: red

polyamide

UL94V-0

3 POLE SOCKET

PRICE...

\$2.95 EA.



OPTREX #DMF50140NF-SEW INTELLIGENT GRAPHIC LCD MODULE

"SUPERTWIST" modules utilize surface mount
technology. Displays blue pixels on yellow/green
background. modules have E-B backlighting -
Graphic-Figure-Character display. Built in Drivers
& 4 bit ttl interface.

*Control LSI: T6963C Toshiba

*View Angle: 6:00

*Dot Size .44(w) x .57(h) mm

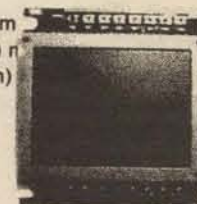
*Dot Pixels 143(w) x 153(h) n

*View area 74.8(w) x 98.4(h)

*Dc Voltage: 5vdc

List Price \$69.95

OUR PRICE..\$14.95



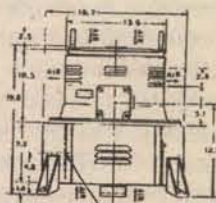
GEORATOR CORP - NO BRUSH

FREQUENCY CONVERTOR #39-002

INPUT: 7.5 HORSE POWER, 3PHASE 60 HZ

OUTPUT: 5 KVA, 1 PHASE 400 HZ

THE "NOBRUSH" VERTICAL CONVERTER IS A VERTICALLY
MOUNTED MOTOR GENERATOR SET USED TO CONVERT
60HZ FREQ. TO 400HZ FREQ. THE LOWER PORTION CONS-
ISTS OF THE GENERATOR & THE UPPER MOTOR.
THE MOTOR & GENERATOR, THE CONTROL WINDINGS AND
THE CONTROL ELECTRONICS ARE ALL PACKAGED TOGETHER
IN A SINGLE UNIT. THE MOTOR STATOR WINDINGS, THE GENER-
ATOR STATOR WINDINGS, AND THE CONTROL TOROIDAL
WINDINGS ARE MOUNTED WITHIN THE CAST ALUMINUM
HOUSING. BRAND NEW - FACTORY PACKED....
WEIGHT 290 LB. - NEW COST \$5400.00
BRIGAR SALE PRICE \$1400.00



OVERBOARD ALARM

A water-activated emergency transmitter and companion alarm receiver has numerous applications for water and wet-snow emergencies. The best feature of the emergency transmitter unit is the capability of actually going underwater, and continuing to work once it floats free. The alarm system was so unique in its multitude of water-related applications that it was

The aeronautical and marine ELTs and EPIRBs are designed to international standards, and are monitored by low-earth-orbit COSPAS/SARSAT satellites. Marine and air ELT activations trigger satellites to retransmit the signal for Doppler analyzation, or through the 406 MHz system store and forward on demand.

This modest ALERT has nothing to do with EPIRBs or ELTs. ALERT is different, and more along the proximity scheme of transmitters and receivers. This water-acti-

by Gordon West

ear interpolations.

With these FCC constraints on how much little power the emergency transmitter can put out to its built-in antenna, we were concerned that someone slipping overboard on a boat might drift out of range before they had enough time to hold the unit at water level or out of the water to get this small signal back to the receiver.

And most important, exactly how far away will the activated ALERT transmitter at 1 milliwatt on 418 MHz trigger the receiver?

To find this out, we first looked at the receiver design. The receiver is a superheterodyne, non-tunable, single-conversion, radio receiver with a local oscillator operating at 10.7 MHz. The heart of the receiver to offer the ultimate in sensitivity at 418 MHz is a sur-

need for individual inductors and capacitors in a regular filter network, and the SAW filter meets a variety of amplitude-response and time-delay requirements, and, most important for the manufacturing process, a relatively low cost.

The receiver draws 100 milliamps and contains a piezoelectric buzzer that is extremely loud when the reception of a signal and 512 Hz modulation is detected at 418 MHz. A latching transistor keeps the buzzer turned on after approximately two seconds of recognizing time. The buzzer may be manually reset, and a red light continues to illustrate an activated alarm.

The receiver works from 12 volts DC, at 500 mA, and incorporates a SAW filter.

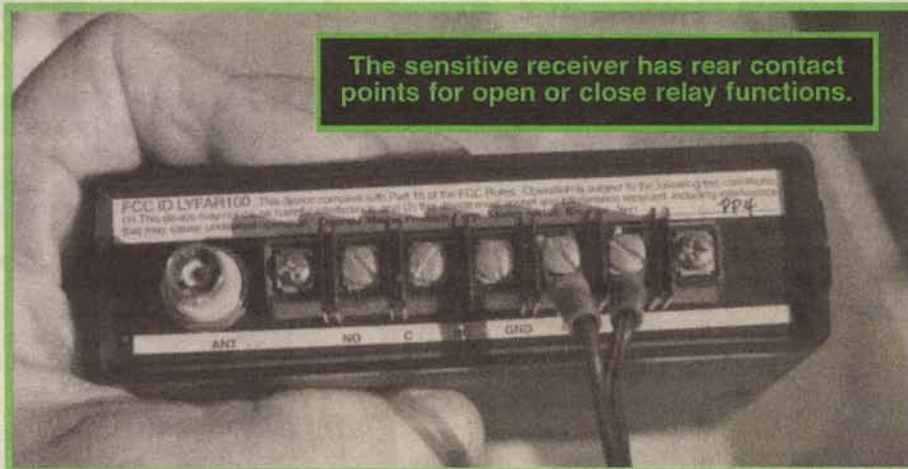


awarded the prestigious National Marine Manufacturer's Association product innovation award at a recent international marine trade show (IMTEC) held in Chicago. This prompted me to further investigate the product, and review its seaworthiness and allied applications in the snow.

This under-\$500 system is simply called "ALERT," and is designed and marketed by Emerald Marine Products in Seattle, WA (800-426-4201). The package contains the eight-ounce floatable emergency transmitter, quick-deploy pouch, two AAA batteries, and the 12-volt receiver/alarm unit that may operate fixed 12-volts, or part of a portable emergency beacon locator pack.

The transmitter is not your customary ELT (emergency locator transmitter) nor is it a marine EPIRB (emergency position indicating radio beacon). The aeronautical ELTs and marine EPIRBs operate on 121.5 MHz, plus simultaneous harmonic transmission on military 243 MHz, and category 406 marine EPIRBs transmit on 406.000 MHz.

The sensitive receiver has rear contact points for open or close relay functions.



ated and fully-submersible transmitter operates at 418.000 MHz maximum 1 milliwatt output, AM modulation with a 512 Hz. The 418 MHz is assigned as a fixed/mobile, catch-all band for proximity devices, including garage doors, car alarms, bugs, and other transmitters rated at -106 dBm with no more output than 1 milliwatt to classify as a Part 15 device.

FCC Rule 15.201(2)(e), a transmitter employed for radio control purposes during emergencies involving fire, security, AND SAFETY OF LIFE may, when activated to signal an alarm, operate during the pendency of the alarm condition.

FCC Rule 15.205(b), fundamental frequency 260 to 470, field strength of fundamental uV/M at three meters, 3750 to 12,500, lin-

face-acoustic-wave (SAW) filter consisting of 10 aluminum electrodes, like fingers, deposited on the surface of a piezoelectric substrate, usually Lithium Niobate (LiNbO3).

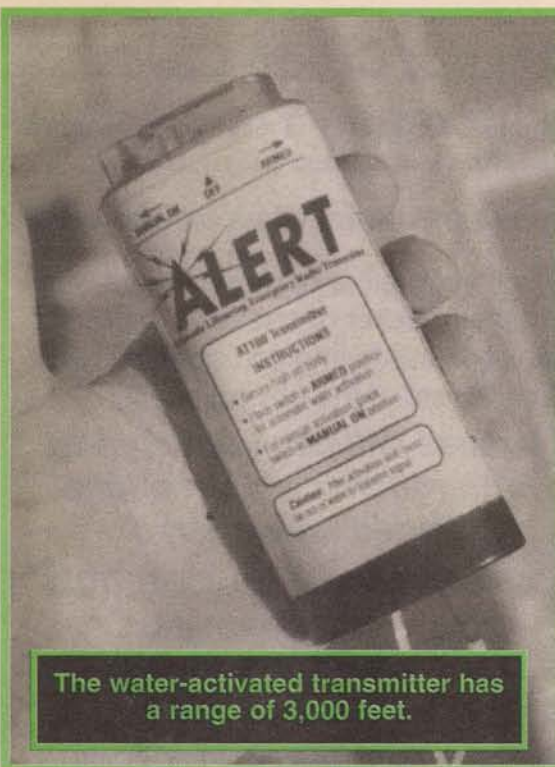
When an RF signal is applied to the input transducer, the electrodes generate an electric field between the fingers, causing the piezoelectric material to vibrate, creating an acoustic wave on the surface. When the wave reaches the output transducer, it is converted back to an electric field between the fingers. It is within this field that a voltage across a load resistor is generated. The center frequency of the SAW device is 407.3 MHz, and this frequency, along with the physical fingers, determine the Q of the filter. This SAW filter eliminates the



A bright orange pouch will affix the transmitter to a life vest for water activation.

On the back of the receiver are contact points for normally open or normally closed auxiliary alerting devices. This could be an electronic siren, bell, buzzer, or even a kill-switch on a boat's engine. The receiver terminates to a BNC receptacle, and the included rubber-duck antenna is only for proximity testing, and not designed for longer range reception.

Josef Tuttle, Vice-President of Emerald Marine Products, recommends a variety of auxiliary gain antennas that will dramatically boost reception range to an in-water alert device. Emerald Marine works closely with Morad, a well-known commercial marine radio antenna manufacturer located nearby in the Pacific Northwest.



The water-activated transmitter has a range of 3,000 feet.

give the overboard person the confidence (if you have any left over, after going overboard) that the device is operating properly.

The transmitter features a variety of washers, gaskets, seals, and O-rings to allow it to pass a one-hour, under-10-feet-of-water test. "The unit only has to be waterproof on the surface, so a 10-foot test should allow for pressure of waves, falling off of a speed boat," comments Tuttle. I ran it in the water for several hours, and the unit continued to operate properly.

Our first tests were conducted over a dry sandy beach. We immediately concluded that the

enced on land increased by five times. Same thing with fresh water tests at a nearby lake — get the unit over water, and reception range dramatically increases.

We later determined that sea water and mineral-laden fresh water are good reflectors at 418 MHz, and this is why the tremendous increase in range over dry sand or pavement.

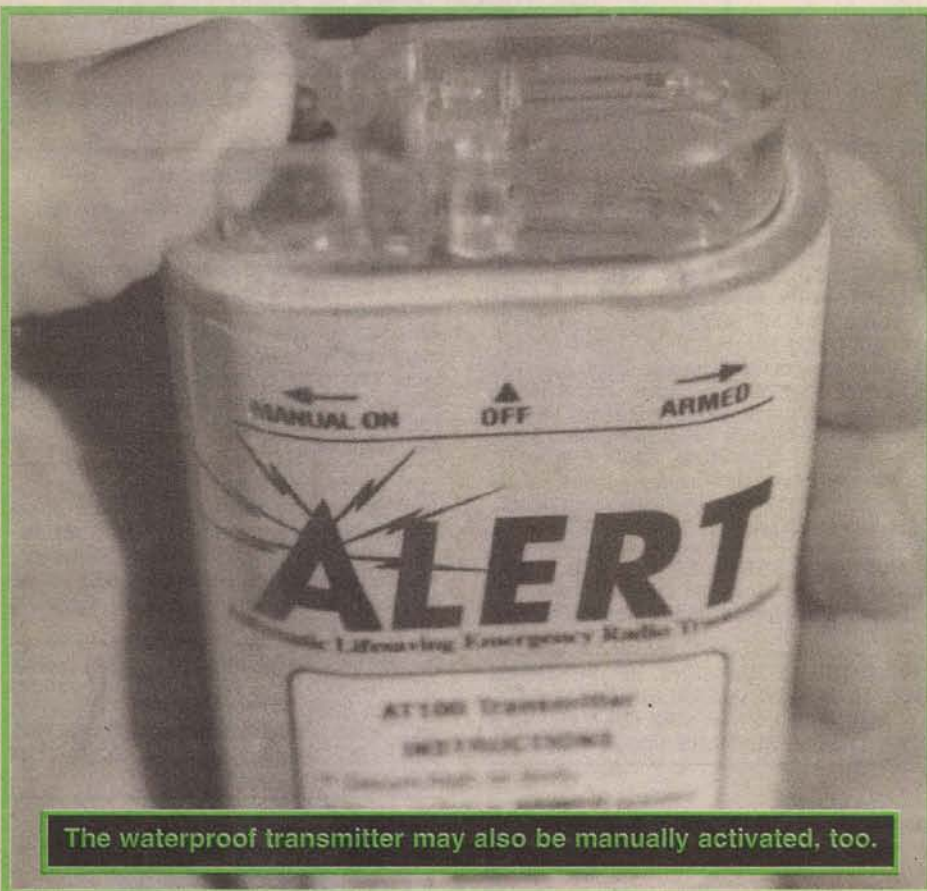
There was also a test on snow with this device, and the snow pack gave us the same range reflectivity as did fresh water. Several emergency groups were contemplating using the alert device as an avalanche victim locator. Someone getting covered up by an avalanche would probably have enough moisture within the snow around his or her body for the unit to self-activate, and a portable alert receiver would begin to sound off when taken to the proximity of a buried transmitter. At this point, the antenna system would be reduced in capabilities until the alert would only go off directly over the buried victim. Start shoveling.

In boat activations, it is imperative that the alert transmitter be at water level or held slightly above water level. The attenuation of UHF signals just one inch below the ocean or lake level is so great that absolutely no reception is obtained beyond 30 feet. The manufacturer recommends placing the unit high up on a personal flotation device (PFD) so an unconscious victim could still achieve automatic water activation. Once the contact points see water between them, the unit still continues to transmit even though the connection dries out. There is also a manual switch for manual transmitter activation.

One mariner was going to purchase several transmitters and affix them to dog harnesses for their pets onboard. Between the shoulder blades on a big animal would certainly achieve automatic water activation, plus probably above-water positioning once the animal comes up for air.

It is the submersible capabilities of the transmitter that truly make this unit stand out from simple security activator devices. I have monitored the 418 MHz channel and have heard little activity on it. Most garage door activators have their own frequencies well separated from this channel.

So, if you are looking for an industrial-strength, water-activated, UHF alarm system, give them a call at Emerald Marine Products, and see how this type of transmitter and companion receiver/alerting device could very well save a life this summer when out on the water, or right now in the winter out in the snow. **NV**



The waterproof transmitter may also be manually activated, too.

Our test antenna was a half wavelength, industrial-quality Morad antenna cut specifically for 418 MHz, requiring no additional ground plane. Coax was low-loss RG-213 to permit the receiver to be mounted down below in a boat, with the antenna up on the bridge.

The transmitter is water-activated automatically when switched to the armed position. When fresh water or sea water, or even wet-snow, bridge the bottom contact points, the transmitter automatically cycles on, and a tiny strobe light confirms the activated ALERT. You don't hear anything other than the strobe oscillator doing its sweep thing. The strobe is truly anemic and really couldn't help much for a nighttime rescue. However, it would

little rubber antenna was only good for about 100 feet of range, and the external Morad UHF-418 HD antenna would have 15 feet of RG-213/U coax to get us out to 500 feet. We tested over and over again on the sand, and 500 feet maximum was the best we could do. But we reminded ourselves that this was intended for on-the-water rescues, so off to the water we went by boat and by surfboard. We couldn't believe what happened.

The range over sea water exceeded 2,000 feet, with now-and-then signals received all the way out to 3,000 feet. Unbelievable. Even with the alert device held just inches above the sea water, reception range over the water than what we had experi-

SMART 110/220 VAC OR SOLAR BATTERY CONTROLLERS

FOR GEL-CELLS OR LEAD-ACID BATTERIES



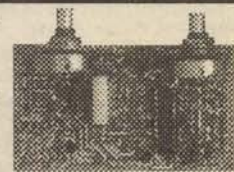
6 TO 28 V.,
50/60 HZ
WILL NOT
OVERCHARGE!

UC3906 I.C. TRICKLE START UP; DBL. SIDED PCB;
SCREW TERMINALS, SWITCHABLE CURRENT;
REVERSE BATTERY PROTECTION; PTC FUSE;
PROGRAMMABLE VOLTS / CURRENTS; MANUAL.
COMPLETE KIT 6V OR 12-14 V. 1 AMP MAX \$126.95
BASIC CONTROLLER 6V OR 12-14V; 1 A MAX ... \$ 54.95
OPTIONS: TRANSFORMER KIT \$ 18.95
AUTO LO-VOLT DISCONNECT KIT:
DISCONNECTS THE BATTERY BEFORE IT IS
DEPLETED WHEN POWER SOURCE IS OFF \$ 18.00
BC-04, UP TO 5 AMPS CHARGING RATE, 12/14 V,
HEAVY DUTY XFMR. FOR DEEP CYCLE HIGH POWER
USAGE. 110 VAC 60 HZ \$ 214.95 PP

3 AMP SOLAR CONTROLLER SENSES IF LIGHT
SOURCE IS ADEQUATE. DUAL LEVEL CONTROL.
CAN ALSO USE AC FOR BACKUP.
COMPLETE W/VOLT & METER 6-14V \$109.95
BASIC KIT 6-14V. (FOR 24-28V ADD \$10.00) \$ 54.95

CURTIS KEYSER KIT .. \$ 39.95

INCLUDES AUDIO AMP,
IAMBIC KEYING,
ADJUSTABLE SPEED



POS/NEG KEY-WEIGHT &
TONE CONTROL \$ 10.00

SPEED METER ... \$ 14.95

8044ABM CHIP ... \$17.95

COMPONENTS

UC3906 BATTERY CHARGER CHIP (\$7.00); LM350K
(\$7.60); 8044ABM LM333K (\$10.60); MC3423P1 (\$3.00);
NE604AN (\$5.00), NE602AN (\$2 EA. \$/5.00); & MORE

ANTENNAS

MARCONI: 80 M - \$39.95; 160 M - \$ 46.95
J-POLES: (2M / 440 DUAL, 6M, 220, 440 MHZ). Kits,
portable, or fixed stationed. Up to 4.6 dB gain over 1/4
vertical \$10.95 - \$ 54.95

TO ORDER: 1-800 JADE PRO: (523-3776)

PHONE: 603 329-6995 FAX: 603-329-4499

<http://www.hampstead.k12.nh.us/~djade/>

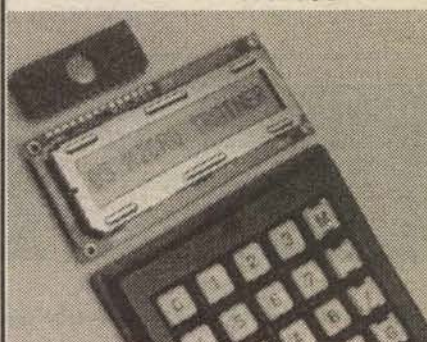
VISA, MASTERCARD, AMEX, NOVUS, CHECK OR MO ACCEPTED

USA SHIP COST: \$6.25 1ST \$100 + \$1.00 /EA. ADD'L \$100.

PRICES AND SPECS SUBJECT TO CHANGE

JADE PRODUCTS, INC. E HAMPSHIRE NH 03826-0368

1-CHIP MICROCONTROLLER TRAINER



TRAINER PARTS KIT INCLUDING:

- Programmed Motorola 68705P3 (only 1 IC required)
- Display 1 X 16 Alphanumeric LCD
- Keypad 5 X 4
- 4 MHz clock oscillator, reset switch, R, C
- MANUALS - experiments & programming - 200+ pgs.

EASY TO USE

- Enter instructions directly using keypad and run your program
- Computer not required
- Learning DOS and assembler not required
- Basic understanding of electronics assumed
- Detailed manuals guide you in learning programming and interfacing circuitry to the microcontroller.

Experiments include an E2PROM programmer and a 68705P3 programmer so you can design and build your own projects

Parts for experiments available separately from us
TRAINER PARTS KIT and MANUALS \$89 plus shipping
VISA, MC, COD CA residents add CA sales tax

Just Add Wire And +5VDC To Get Started

SQUARE 1 ELECTRONICS

P.O. Box 501, Kelseyville, CA 95451
Order (800) 220-3916
Support (707) 279-8881
FAX (707) 279-8883
Hours 7AM - 4PM Pacific M - F

PRINT T-SHIRTS FOR FUN OR PROFIT!

With your computer!



**FAST, EASY with
Heat Transfer Printer Ribbons!**

1. Put Ribbon into your printer.
2. Print message or design onto regular paper but print it in a mirror image. (Print Shop and other programs have this capability.)
3. Place paper face down on T-shirt and iron the back of paper to transfer the image.

Available in red, green, blue, or black at \$10.95 each for the following printers (specify make and colors wanted):
Panasonic 1080/1180/1090/1190/1123/1124; IBM Proprinter; Epson MX/FX/RX 80/85/86e/LX800/LQ500/LQ510/LQ570/L1000; Star NX/NL/ NP10; Seiksha SP800/1000; Tandy DMP130; Apple Imagewriter; Citizen 120D/180D/GSX140; Okidata 182/192/320.

\$11.95 each for Epson MX/FX-100/286e, LQ1000/1050, LQ2500/2550/EX800/1000/LQ860, AP3250/LQ100 Star NX1020/2400/2410/2415/2420, Panasonic KX-P 2180/2123/2124/1624/1524, Toshiba P321/351/1340. \$5.95 each for Okidata 82/92/83/93, Gemini 10X/15X.

Available in **BLACK** only at \$10.95 each for Star NX1000, NEC P2200, Commodore MPS-801.

Available in 4-Color Heat Transfer for Imagewriter II, \$12.95; Star NX1000 \$14.95; Star NX1020 \$23.95; Star NX2420 \$23.95; Star NX2450 \$23.95; Citizen GSX-140 \$23.95; Epson LQ2500/2550/EX800/1000 \$16.95; Fujitsu DX2100/2200/2300/DL 3300/3400/3600 \$27.95; Panasonic KX-P 2180/2123/2124 \$23.95.

HEAT TRANSFER MARKING PENS

Add colors to the computerized design or use alone. Set/5 Colors (red, orange, yellow, green, blue) wide pens \$15.00, narrow pens \$14.00.

HARD-TO-GET PRINTER RIBBONS

Gorilla Banana, Commodore 1525 \$8.00; Adam Coleco \$12.00; TI-850/855 \$6.00; Centronics 700 Zip Pack \$5.00; C. Itoh Prowriter Jr., Riteman C+/F+ \$6.00; Riteman Infomrunner \$8.00; Commodore MPS-801 \$5.00; MPS 803 \$5.00; Decwriter LA30/36 \$4.00; Apple Scribe \$4.00; Mannisman Tally Spirit 80, Commodore 1526 \$5.00; Epson JX-80 4-Color \$14.00. Printronix P-1013 \$11.00.

Over 200 different ribbons in stock. All ribbons new, not re-inked. Fully guaranteed. Order directly or send SASE for complete list.

Add \$2.00 per order shipping. California residents add 7.75% sales tax. On ribbon orders over \$30.00 deduct 10% discount.

H.T. ORR Computer Supplies
249 Juanita Way, Placentia, CA 92670



714-528-9822

800-377-2023

FAX 714-993-8216



Write in 166 on Reader Service Card.

When Visiting Disney World And Sea World.
Come To The World Of Electronic Surplus!

SKYCRAFT

PARTS & SURPLUS, INC.
ORLANDO, FLORIDA



Located At The Intersection Of I-4
And Fairbanks Avenue.

A Self-Service Retail Outlet Featuring Commercial
And Government Electronic Surplus Including:

★ WIRE
★ SWITCHES
★ RESISTORS
★ TRANSISTORS
★ TRANSFORMERS
★ TEST EQUIPMENT
★ NI-CAD BATTERIES

★ COAX
★ RELAYS
★ HARDWARE
★ CAPACITORS
★ PANEL METERS
★ CIRCUIT BOARDS
★ INTEGRATED CIRCUITS

HOURS:

Monday - Friday 8:30-6:00
Saturday 8:30-5:00

★★★★★★★★

We Buy Surplus
Electronic Parts —
FAX your list.

FAX 407/647-4831

PH 407/628-5634

P.O. BOX 536186

ORLANDO, FLA. 32853-6186



TEST EQUIPMENT cont.

HP 3571A tracking spectrum analyzer in good condition \$350. 415-244-9254.

HEWLETT PACKARD 8590A spectrum analyzer, 10KHz-1.5 GHz, RS-232, \$1,800. 407-984-9467.

GENUINE TEK MANUALS 2246, 2230, DM502, DC503, DC504, FG503, PG506, PS503, SG503, TG501, TM504, \$19 each. 543, 2215 Service \$59 each. Others. SYN-ERGETICS SURPLUS, Box 809, Thatcher AZ 85552. 520-428-4073. VISA/MC.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. KEYWAYS, INC., 513-847-2300 OR fax 513-847-2350.

TEST EQUIPMENT SALE: HP 8690A, \$200; HP 8690B, \$250; HP 626A, \$250; HP 3320B, \$400; HP 8616A, \$450; HP 8614A, \$450; HP 3200B, \$200; Wavetek 907, \$500; HP 8699B 100MHz-4GHz sweeper PI, \$400; HP 86XX plug-ins, call; HP 3330B synthesizer, \$500; HP 5004A sig. ana., \$200; HP 3964A 4 channel instrumentation recorders, \$500 ea.; JVC CR600U video recorder, \$600; JVC CR850U editing cassette video recorder, \$800; Panasonic BT1300N 14" color monitor, \$300; Fluke 6160B synthesizer, \$400; Fluke 645, \$300. Send for test equipment sales list. A-Comm Electronics, 7198 S. Quince St., Englewood, CO 80112. 303-290-8012.

WANTED: SERVICE monitors. IFR, Motorola, Marconi; HP signal generators, spectrum analyzers, etc. 716-661-9964 or fax: 716-763-0371.

USED TEST EQUIPMENT. HP, TEKTRONICS, FLUKE. WHOLESALE PRICES. CALL TO RECEIVE LIST BY FAX OR MAIL. TJ'S WHOLESALE SURPLUS. 904-897-6482.

Accept Credit Cards and Increase Your Sales!

MasterCard, Visa, American Express*, Discover*

All Types of Businesses Considered

Why limit yourself to only customers with cash in their pocket or checking account? Accept credit cards and you open the door to the rest of the buying public!

**Jim Krause will pay your sign-up
fee to Cardservice International
(Limited time offer)**

No sign-up fees if you act now!

Call or Fax for Free Info:

Jim Krause, Cardservice

Voice & Fax (310) 694-0565

Cardservice International, A Registered Agent for
Bank of Oakland, Oakland, CA; First Bank of Beverly Hills,
Calabasas, CA; Humboldt Bank, Eureka, CA; Redding Bank of
Commerce, Redding, CA; Tehama County Bank, Red Bluff, CA
(All Banks FDIC Insured)

*American Express & Discover subject separate approval

Write in 127 on Reader Service Card.

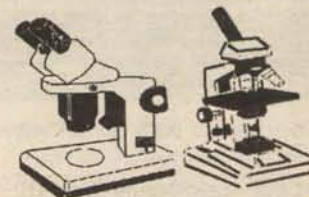
HP 3730B down converter \$650/offer. Dexis, 612-944-7670.

KROHN-HITE 2,000 sweep generator \$275. Dexis, 612-944-7670.

WE BUY all brands of electrical test equipment used for testing high voltage power systems. This includes: Multi-Amp Hipotronics, Biddle, Megger, Associated Research and EIL. Call or fax Phase-3, 1-800-261-9139, Fax: 214-564-9139.

TEK DIFFERENTIAL Plug-ins: 7A13 is a 100MHz differential plug-in with LED offset voltage display for effective 10,000 cm display height. 7A22 has microvolt sensitivity with selectable highpass/lowpass filter corner frequencies. \$190 each/both \$350. Excellent condition. 602-655-9434.

HP 1741A 100MHz storage scope in perfect working condition and calibrated at special price of \$425. 90-day warranty. Tek 475A with DM44 o'scope 250MHz \$550. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.



STEREO MICROSCOPES for surface mount work at 10X and PC inspection at 30X. Top and bottom illumination, 2-year warranty, delivery to 48 states \$365. Student microscopes from \$150. Used stereos, micro-optics available. Seabird Technical, Box 2438, Menlo Park, CA 94026-2438. Phone 415-367-8320, Fax 415-365-5845 Visa/MC.

WANTED: FREQUENCY SELECTIVE LEVEL METERS. CUSHMAN CE-24As, RYCOM 6040 OR 6041s. WE PAY CASH WITHIN 24 HOURS OF EVALUATION. CALL 601-868-6596 OR FAX INFO TO 601-868-0133.

FLUKE 1900A counter 5Hz to 80MHz. \$175/offer. Dexis, 612-944-7670.

TEST EQUIPMENT: TEK DA4084 (like AA5001) DISTORTION ANALYZER, \$1,100; TEK 475 200MHz SCOPE, \$650; HP 3300A FUNCTION GENERATOR, \$115; HP 427A MULTIMETER, \$85; KROHN-HITE 4100R OSCILLATOR, \$110; OTHER EQUIPMENT ALSO; CALL RALPH, 719-495-4344.

EAST COAST Z-MAN

1-800-945-6625

ST 1000s SCREENED & CLEANED

\$40⁰⁰ EA.

8 UNIT MINIMUM

(Overstocked Field Pulls) • Other Models Available

CALL 1-800-945-6625 TODAY!

CALL TOLL FREE
(800) 292-7711
Se Habla Español

C&S SALES

EXCELLENCE IN SERVICE

**WRITE FOR A
FREE 60 PAGE
CATALOG!**

AFFORDABLE, HIGH QUALITY ELENCO OSCILLOSCOPES 2 YEAR WARRANTY



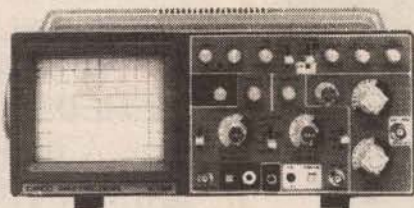
STANDARD SERIES

S-1325 25MHz \$335
S-1340 40MHz \$489

Features:

- TV Sync
- 1mV Sensitivity
- X-Y Operation
- High Luminance 6" CRT
- Complete Schematic
- Plus much, much more!!

2 FREE probes included with each scope!!



DELUXE SERIES

S-1330 25MHz \$439
S-1345 40MHz \$569
S-1360 60MHz \$759

Features:

- Delayed Sweep
- Automatic Beam Finder
- Z Axis Modulation
- Built-in Component Test
- Plus all of the features of the "affordable" series!!
- Dual time base
- Illuminated internal gradicule

MX-9300

Four Functions in One Instrument

Features:

- One instrument with four test and measuring systems:
- 1.3GHz Frequency Counter
- 2MHz Sweep Function Generator
- Digital Multimeter
- Digital Triple Power Supply
- 0-30V @ 3A, 15V @ 1A, 5V @ 2A

NEW!



\$479.95

B&K 2MHz Function Generator Model 4010

\$195.95



- 0.2Hz to 2MHz
- Sine, Square, Triangle, Pulse and ramp output
- Variable duty cycle
- Variable DC offset

Model XP-581

4 Fully Regulated Power Supplies in One Unit

4 DC voltages: 3 fixed - +5V @ 3A, +12V @ 1A, -12V @ 1A • 1 Variable - 2.5 - 20V @ 2A

Ideal for laboratories, service shops and hobbyists.

\$85



Fluke Multimeters

70 Series

Model 701I \$69.95
Model 731I \$97.50
Model 751I \$135.00
Model 771I \$154.95
Model 791I \$175.00

80 Series

Model 83 \$235.00
Model 85 \$269.00
Model 87 \$289.00

Model M-6000

Features Computer Interface and Software



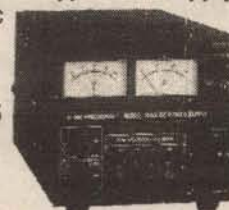
- Frequency to 4MHz
- Capacitance to 40nF
- Large 3 3/4 LCD Display
- Temperature to 1999°F
- TTL logic
- Data/Peak Hold
- Audible continuity
- Auto power off
- Unit indicator
- Diode test
- w/ RS232 Cable

\$99.95

B&K Model 1688

High Current (25 amp) Power Supply
Variable 3-14VDC

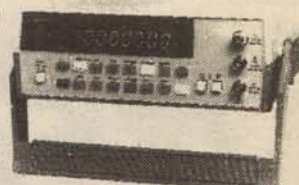
\$249.95



1.3GHz Universal Counter Model F-1300

- Period
- Frequency
- & 8 other functions

\$225



M-1700 Digital Multimeter

11 functions including freq to 20MHz, cap to 20µF. Meets UL-1244 safety specs.

\$42.95

Kit Corner over 100 kits available

Model AR-2N6K

2 meter / 6 meter
Amateur Radio Kit

\$34.95

Model AM/FM-108K

AM/FM Transistor Radio Kit

\$29.95



M-2665K Digital Multimeter Kit

\$54.95

Full 34 Ranges w/ cap & trans tests

TT-400K Telephone Analyzer Kit

\$19.95



XK-550 Digital / Analog Trainer

Elenco's advanced designed Digital / Analog Trainer is specially designed for school projects. It is built on a single PC board for maximum reliability. It includes 5 built-in power supplies, a function generator with continuously sine, triangular and square wave forms. 1560 tie point breadboard area.

XK-550

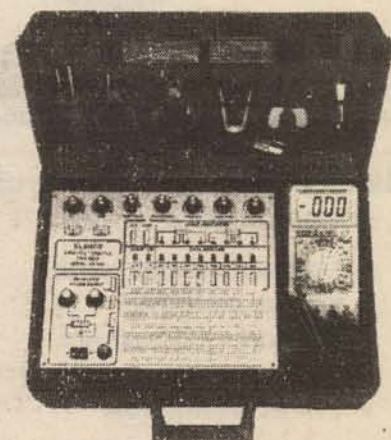
Assembled and Tested

\$169.95

XK-550K - Kit

\$139.95

Tools and meter shown optional



WE WILL NOT BE UNDERSOLD

C&S SALES, INC.

150 W. CARPENTER AVENUE
WHEELING, IL 60090

FAX: (847) 541-9904 (847) 541-0710



**15 DAY MONEY BACK
GUARANTEE**

FULL FACTORY WARRANTY

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

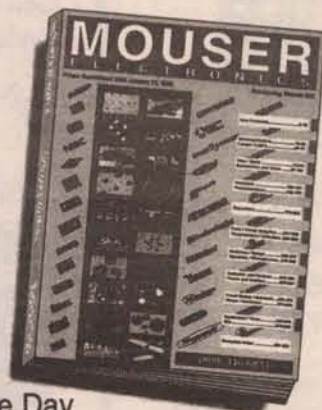
UPS SHIPPING: 48 STATES 5%
OTHERS CALL (\$3 min. / \$10 max.)
IL RES. 8% TAX

IN STOCK

quality \ 'kwäl - at - ē \ noun

- An inherent and essential feature or element exhibiting a degree of excellence and superiority.
syn. see Mouser Electronics

Call for your
FREE 324
page catalog
TODAY!



61,601 Products
120 Manufacturers
All Orders Ship Same Day

- Passive Components ■ Semiconductors
- Electromechanical ■ Connectors/Cable
- Surface Mount and Through Hole

MOUSER[®] ELECTRONICS

800-992-9943
FAX: 817-483-0931
<http://www.mouser.com>

958 North Main St., Mansfield, TX 76063

Write in 88 on Reader Service Card.

CME-2.4T/RD COMPLETE 2.4 GHZ - 4 CHANNEL - WIRELESS VIDEO/AUDIO TRANSMITTER/RECEIVER SYSTEM (500 FOOT PLUS RANGE WITH BUILT IN ANTENNAS)

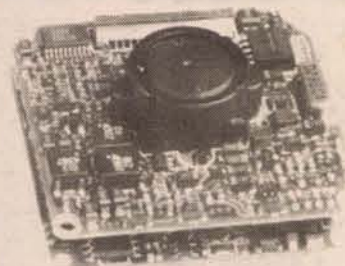


NOW ONLY \$ 169.99 (MARCH ONLY)

- USE FOR ANY WIRELESS VIDEO APPLICATION
- BOTH UNITS 7" x 4.5" x 2" IN SIZE
- 12 VDC OPERATION (AC ADAPTERS INCLUDED)
- FCC CERTIFIED

CME-200CP SUB-MINIATURE COLOR CAMERA MODULE

- 1/3" CCD PICKUP DEVICE
- 2.5 LUX SENSITIVITY
- 492 LINES RESOLUTION
- STANDARD VIDEO OUTPUT
- 12 VDC OPERATION
- 1-5/8" SQUARE X 5/8" DEEP



\$ 399.00

CREATIVE MICRO ELECTRONICS, Inc. (CME)

PHONES: (800) 771-1295 (OUT OF COLORADO ONLY) (303) 771-1288
FAX: (303) 771-1136

P.O. BOX 4477 - ENGLEWOOD - COLORADO - 80155

VISA - MASTERCARD - DISCOVER & AMERICAN EXPRESS ACCEPTED

Mr. NiCd

E.H. Yost & Co. - YOUR SOURCE FOR

Mr. NiCd

★ BATTERIES! ★

- ★ AMATEUR / COMMERCIAL / AVIATION RADIO ★
- ★ LAPTOP COMPUTERS ★ VIDEO CAMCORDERS ★
- ★ CELLULAR & CORDLESS TELEPHONES ★
- ★ SEALED LEAD ACID ★ PHOTOGRAPHY ★
- ★ MEDICAL EQUIPMENT ★ TESTING EQUIPMENT ★

CALL OR WRITE TODAY FOR OUR FREE CATALOG!

Phone (608) 831-3443 / Fax (608) 831-1082

E.H. Yost & Company 2211-D Parview Rd., Middleton, WI 53562

TEST EQUIPMENT cont.

RF TEST EQUIPMENT: HP 5342A/1 18GHz counter (oven option) \$2,100. HP 3403C/3, 6 RF voltmeter \$375. HP 8660C/005, 100 signal generator mainframe \$1,700. HP 86222B .01-2.4 GHz sweep oscillator \$1,600. HP 11869A adapter for 8350B \$350. HP 8350B sweeper mainframe \$4,100. Tek P6201 900MHz active probe \$350. HP 8405A vector voltmeter with accessories \$650. Excellent condition as always, with warranty. Pepper Systems, 214-353-0257.



UJ'S® CELLULAR EMULATOR SYSTEM, COMBO SALE, MARCH, APRIL, AND MAY, INCLUDES FREE, MOTOROLA'S NEW CELLULAR TECHNICIANS TRAINING MANUAL (212 PAGES OCT. '95). ALSO SALES, REFURBISHED CELLULAR PHONES. SEE OUR DETAILED ADS IN TELEPHONE/FAX CLASSIFICATION. LESS BUSTER'S ELECTRONICS, 702-642-0325.

HP 8405A VECTOR voltmeter \$275, Tek Z plug \$50, Tektronix 5110 w/5A15N, 5B10N oscilloscope \$300, Keithley 6162 isolated output/control \$100, HP 1610A, 1610B logic state analyzer \$75, Tek 7844 400MHz oscilloscope \$300, HP 431A power meter \$60, HP 350B attenuator set \$50. HP 34702A multi-meter \$100, Fluke 1953AE counter timer \$200, Tek 7B71 \$100, Tek P6452, P6455 data acquisition \$40, General Radio 1432-K decade resistor \$50, Fluke 2204A scanner \$100. Call 714-827-7345.

HP 3586B OPT. 1 \$600, 4 HP 6992A extender box with 33 cards total \$300 a box, HP 86260A RF plug-in \$575. Ty Miller, Southcoast Surplus, 714-830-9170, FAX 714-454-9841.

TEST EQUIPT, HP1B, excellent, Hewlett Packard: 3325A/002 \$1,995; 8165A/002 programmable signal generator \$1,995; 8160A programmable pulse generator \$1,695; 3455A DVM \$595; 5328A universal counter \$295; 3465A DVM \$350; 3575A gain-phase \$595; 3437A system voltmeter \$395; 141T analyzer, 110MHz system \$1,095, plug-ins: HP 8553B 110MHz RF \$250; HP 8552B IF \$395; 141T cable clones. Call. Wade 309-523-3262.

WANTED: LATE MODEL TEST EQUIPMENT Tektronix, HP, Fluke). Especially: Tek SG 505 oscillator plug-in, Tek S-52 pulse generator plug-in. Also, we buy test equipment manuals and catalogs. Pepper Systems: 214-353-0257; 214-902-9511 FAX.

WAVETEK: VHF/UHF single frequency markers for 1801 series sweep/generator. For required markers and best price mail SASE to EO Techniques, 16 Slusser Ave., New Hartford, NY 13413-2117. Phone 315-733-4852.

TEKTRONIX R564B storage scope rack mount w/o plug-ins \$195. SG85/URM 25-D \$29. HP 3304A sweep offset plug-in \$45. HP 204C oscillator plug-in \$49. HP 4329A high resistance meter (minor repair) \$39. Fluke 853A differential multimeter \$45. Lambda LRA-16 rack adapters w/4 smaller supplies integrated as one unit. 5VDC @13amp, balance monitoring, fine adjustment functions, etc. Beautiful. \$49. Nevada Metals Co., 310-491-3181 or fax 310-491-3182.

POWER SUPPLIES HP 6224B 0 to 24V/3A \$150, KEPCO JQE36-3M 0 to 36V/3A \$150, LAMBDA LK351 0 to 36V/25A \$495, POWER DESIGN 1210S 1 to 12V/10A \$150, POWER DESIGN TW6050A quad output 0 to 7V/5A, 0 to 15V/3A, 0 to 24V/2A 0 to 60V/1A \$250. 30-day warranty. WE HAVE 500 POWER SUPPLIES IN STOCK. ANY VOLTAGE ANY CURRENT. Visa & MasterCard accepted. CALL 1-800-435-1516, FAX 908-280-0111.

WORLDWIDE TEST EQUIPMENT Resource Center: Ultimate resource solutions buying and selling electronic test equipment, manuals & parts via the Internet. Upload your inventory, parts and manuals today! Visit the Dead or Alive forum for inoperative equipment. Industry leading repair services available (RF specialists). Ask about our no evaluation fee policy! www.NTECUSA.COM E-Mail sales@NTECUSA.com call 619-754-9141 or fax your list to 619-433-4374.

INSTRUMENT SALE: HP 5328A universal counter with 50 MHz, option only \$425. HP 8413A phase gain indicator \$200. HP 1122A probe power supply \$85. HP 5554A pre-amplifier \$60. HP 5381A 80MHz counter \$75. HP 8750A storage normalizer \$350. HP 4944A transmission impairment test set \$475. HP 28687A network wire tester \$450. HP 28687-63003 loop back hood acc. \$75. Fluke 8100B digital meter \$100. Shipping and COD extra. 415-842-3268 Fax: 510-389-4780.

TECH SYSTEMS WANTS YOUR SURPLUS ELECTRONIC TEST EQUIPMENT, MANUALS, COAX & WAVEGUIDE COMPONENTS. TOP DOLLAR PAID. CALL 1-800-435-1516 OR FAX LIST TO 908-280-0111.

FOR SALE: Tek 7000 series plug-in extender fixtures. Rigid type \$150. Flexible cable type \$160. Excellent condition. For repair and calibration of scope plug-in modules. Stan 714-841-5866.

SEND SASE (business size) for 6-page listing of used test equipment. John Micek, 113 Oakdale Dr., Warner Robins, GA 31088. Ph. 912-922-8244.

FLUKE 8922A & 1120A voltmeter RMS \$575/offer. Dexis, 612-944-7670.

50MHZ PULSE generator, Cronetics PG-12 in good condition \$140. 415-244-9254.

ADD OPT. 002 (512MHz-1024MHz) to your HP 8640B. Exceeds all HP specifications. \$499 installed. Includes 1 year NIST traceable calibration. Advanced Engineering & Calibration. 410-643-1581, 410-643-1158.

WANTED! TEST equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424.

SYSTRON DONNER, 5000A, 5015-5 10.7-11.7 GHz sweeper and frame, \$200; 5000A 5007, 10-110MHz, \$200; 7000 XY display, \$150; Tektronix 2101 pulse gen., \$150; Tektronix 7A19, \$200; HP 651B, \$200; HP 653A, \$150; HP 654A, \$200; HP 5314A counter, \$150; HP 5328A, \$400; HP 1600A logic ana., \$300; HP 8405A vector phase meter, \$500. A-Comm Electronics, 303-290-8012.

DC TO GHZ! HP 745A/746A AC standard calibrator, \$650. HP 905A, HP 907A coaxial sliding loads \$175 each. Fairchild EMC-10 EMI test set/spectrum analyzer, 10Hz-500KHz, remote meter, amp clamp, antenna kit, book \$2,400 OBO. EMI TCR40S45-2-D-0V supply, LCD meters, \$495, others \$350+. Sierra 125B spectrum analyzer, 0-620 KHz, \$150. Singer/Panoramic SSB-3B spectrum analyzer, TMI-1A, TMI-4/120 telemetering indicators, TMC-505 simultaneous five point calibrator, all 4 \$900. Rotek/Weston 650A current calibrator AC-DC to 50 amp \$950. TS-1011/UPM-84 spectrum analyzer, 10-40,000 MHz \$350. Empire NF-157 broadband power density meter 200-10 GHz, antenna kit, case, manual \$995. Collins 32MS-1B transceivers, 4 channel KWM-2, \$260 each. General Precision FSN 6625-751-9471 ASB simulator \$125. Tektronix 661 scopes with 4S1/5T3 samplers, both \$240. Hughes 105A Memoscope with 6 assorted plug-ins \$140. Scopes, analyzers, generators, telemetry, microwave, TWTs, reflectometers, Collins parts, transducers, tubes, etc. OBO. For huge list, 3 stamps. Also send your lists. Art, 4601 Yellowleaf, Fort Worth, TX 76133. 817-370-2575.

WANTED: TEKTRONIX type 127, type 133, and type 132 preamplifier power supplies. Also interested in Tektronix type 123 preamplifier. Mike Edwards 805-966-9446 phone (H).

WANTED! TEST equipment. We pay top dollar for used scopes, generators, analyzers from HP, Tektronix, and others. Call Charles at Metric for immediate quotation. 1-800-432-3424.

FEITEK HAS the test equipment you want at reasonable prices. We buy, sell, and trade HP, Tek, GR, etc. Call or fax Monday thru Friday, 9 to 5, 314-423-1770, or write us at Box 3423, St. Louis, MO 63143.

ELECTRONIC TEST EQUIPMENT. BUY, SELL, TRADE. TECH SYSTEMS WANTS YOUR SURPLUS TEST EQUIPMENT/MANUALS/COAX & WAVEGUIDE COMPONENTS. TOP DOLLAR PAID. CALL 1-800-435-1516 OR FAX 908-280-0111.

FLUKE 8000A digital multimeter \$59. Other equipment available with SASE. Call RT Burton and Company, 706-796-2219, FAX 706-796-0056. PO Box 6087, Augusta, GA 30916.

TEKTRONIX P6465 pattern generator & P6461 data acquisition probes. 545B scope \$195. Type CA dual trace plug-ins \$100. For parts: 545B \$50, w/53/54C plug-in \$95. HP 606A \$40 CM-452/GRC-201 signal comparators \$49. HP 5245L frequency counters w/5253B \$65. Lambda 5V $\pm 5\%$ 150 amp. RPS \$45. Dana 4530 digital voltmeter w/module 350, rack mounted. \$45. SG 376/U audio signal generator \$49. Nevada Metals Co., 310-491-3181 or fax 310-491-3182.

TEK 2445 150MHz o'scope 4 independent channels, special price, \$1,100. ISA, PO Box 6955, Laguna Niguel, CA 92607. 714-488-0010, FAX 714-488-0299.

WANTED: MOTOROLA R-1150A CODE SYNTHESIZERS. WE PAY CASH WITHIN 24 HOURS OF EVALUATION. CALL 601-868-6596 OR FAX INFO TO 601-868-0133.

AUDIO OSCILLATORS HP 200CD \$95, HP 200AB \$95, HP 651B \$275. HP 654A \$550, Trio AG203 10Hz-1MHz sine and square-wave, built-in attenuator, solid state \$125. Tested and guaranteed. 516-487-9797 Alan.

Asset Sales

Electronic Test Equipment

BUY • SELL

Test Equipment Wanted

Hewlett-Packard • Tektronix • Fluke • Wiltron

Looking for Test Equipment Manuals?

Contact: Manuals Plus (801)882-7188 • Fax (801)882-7195

Sunnyvale Store	Seattle Store	Corporate Offices
1190 Kern Ave.	285 S.W. 41st St.	P.O. Box 1762
Sunnyvale, CA 94086	Renton, WA 98055	San Mateo, CA 94401
408-735-0657	206-251-6960	415-579-1711
email asi@best.com		Fax 415-579-5777

Write in 126 on Reader Service Card.

HP 214B high amplitude pulse generator, exc. cond. \$1,250. 520-432-1229.

IFR 1500-02 service monitor 3 months total use like new \$6,500. Dan Beyond Oil 415-388-0838, FAX 415-388-9178.

SECURITY

CCTV EQUIP. Police cruiser video systems. Wattec color CCD camera Tamron 3-8 zoom lens. Sony 4" flat screen Toa wireless mic sys. Steel box w/temp control. Odetics VCR w/time/date, relays mounts, wire harness, hdre. PS. Reg \$3,200. \$1,500 ea. Complete 617-933-0827.

PROFESSIONAL ALARM EQUIPMENT/SERVICES. SASE for a complete list: WCE, PO Box 1175, Dania, FL 33004-1175.

SECURITY TECHNICAL help online 24 hours a day on the HES BBS via modem: 908-840-6921.

SURVEILLANCE, COUNTERSURVEILLANCE, lockpicking, tricking, and tracking. The TOP 50 products/video/books/tools and tricks used by the FBI, CIA, KGB, investigators and nosey people. No competition. No kidding. Catalog \$5 (\$11 credit card phone orders). Intelligence Incorporated, 2228 El Camino, San Mateo, CA 94403. 1-800-805-5544.

ALARM CONTROL panels, power supplies, contacts, motion detectors, sirens, strobes, metal enclosures, timers, water gas and temperature sensors. Send \$2 for catalog: HES Electronics, PO Box 183, Brick, NJ 08723.

SPECTRE

SECURITY HACKERS BLACK BOOK: Incredible manual describes in gut-wrenching detail the workings and vulnerabilities of every known security and intrusion detection system in use! Covers: Keypad locks, motion detection and electronic field sensors, window breakage detectors, card access control systems, magnetic locks and contacts, security lighting and CCTV, alarms, safes, electrified fences, more! Includes complete locksmithing course on all other locks in use: Pin tumbler, wafer tumbler, lever, warded, and tubular locks. All for only \$20. Spectre Press, PO Box 5112, North Muskegon, MI 49445.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-842-5953, FAX: 818-845-3613.

THOUSANDS OF CD-ROMS \$5 EACH 5 FOR \$19

DESK TOP PUBLISHING & GRAPHICS

CLASSIC CARS VOL.1, 2, Or 3
LACE & LINGERIE
MASTER CLIPS 1000
NATIONAL PARKS
PRETTY WOMEN 1
STOCK PHOTOS SWIM SUITS
STOCK PHOTOS TEXTURES
SWIM SUITS 1
TEMPRA-KODAK PHOTO CD
EDUCATION & CHILDREN'S
DINOSAUR SAFARI
DR. T'S SING ALONG
DR. T'S AROUND THE WORLD
HARRY'S STORY DISC & COLORING BOOK
MARIO IS MISSING DELUXE
MARIO IS MISSING WWORLD ATLAS
MARIO THE EARLY YEARS
MARIO'S TIME MACHINE
SPACE SHUTTLE MPC
CD STORYTIME-INTERACTIVE
GAMES & ENTERTAINMENT
APOGEE GAMES
ARCADE COMPANION
DOOM COMPANION
EPIC GAMES
CD FUNHOUSE 9.0
HOUSE OF GAMES II
JAZZ JACKRABBIT
JOURNEYMAN PROJECT TURBO
PINBALL FOR WINDOWS
WHO KILLED SAM RUPERT
ULTIMATE DOMAIN-MIDEVIL
STAR WARS CHESS
WOLFENSTEIN-3D-ARCADE GAME AND ADD-ONS
REFERENCE & BUSINESS
AUDUBON BIRDS OF AMERICA
MICROSOFT BOOKSHELF
COLOSSAL COOKBOOK
FAMILY DOCTOR VER.2
ENCYCLOPEDIA OF KNOWLEDGE
GROlier's MULTIMEDIA ENCYC. 5.0
SHERLOCK HOLMES ON DISC
INTERNET SAMPLER
AUDUBON'S MAMMALS
MONEY IN THE 90'S
COMPLETE WORKS OF SHAKESPEARE
SPACE MISSIONS
U.S. ATLAS 3.0
WORLD ATLAS 4.0
9-DIGIT ZIP CODE DIRECTORY
*** ADULTS ONLY - MUST BE OVER 21 ***
ALL BEAUTIES 2
ANGELS ON ANGELS-PHOTO-CD
BLOOMING ANGELS
INTERACTIVE ADULT CALENDAR
EXOTIC ANGELS-PHOTO-CD
EROTIC ILLUSIONS SAMPLER
GLAMOUR GIRLS
PHONE SEX-SEXY SOUNDS
TREASURES OF SPICE
TREASURE CHEST

Download our Catalog or

Call Today for Complete List

800-410-BOBS (2627)

<http://www.shore.net/~crazybob/>



50 New Salem St.
Wakefield, MA 01880
Tel 617-246-6767
Fax 617-246-6776

WE PURCHASE MOST TYPES OF UNMODIFIED CABLE EQUIPMENT
• NEW OR USED • U.S. SYSTEM - NTSC
• 10 TO 1000 UNITS • WE PAY THE FREIGHT
• GUARANTEED CASH FUNDS

PHONE **1-800-448-9020** ASK FOR PURCHASING

OR FAX US YOUR INVENTORIES AT: **1-800-448-5032**

NATIONAL CABLE SERVICES

Questions & Answers

TECH FORUM

This is a READER TO READER Column. All questions AND answers will be provided by *Nuts & Volts* readers and are intended to promote the exchange of ideas and provide assistance for solving problems of a technical nature. All questions submitted are subject to editing and will be published on a space available basis if deemed suitable to the publisher. All answers are submitted by readers and **NO GUARANTEES WHATSOEVER** are made by the publisher. The implementation of any answer printed in this column may require varying degrees of technical experience and should only be attempted by qualified individuals. Always use common sense and good judgement!

QUESTIONS

I am looking for information on an EPROM programmer Model EP 804 made by a company named Digelec. Does anyone know anything about this programmer or the company?

3961 Mike Young
Newville, AL

I am designing a particular receiving antenna for my stereo so that the signal "coming in" will keep its "composure" whenever somebody walks through the room. Do I need an inside or an outside antenna? And if so, would a TV antenna "extend" the reception? I am now experimenting with an element from an electric stove that looks like a circle and/or spiral. Any more ideas that I could try, or any suggestions?

3962 Sean Ingram
Amelia, VA

I need a belt diagram for a Telefunken Magnetophon 204TS-4 reel-to-reel tape machine (German). I have a manual and circuit diagrams. I need to know where drive belts go.

3963 David Pickwell
Austin, TX

How can I read tire air pressure in a car with gauges mounted on the car's dash?

3964 Roland Siller
Benson, NC

I need a 10 minute timer that lights up one LED each minute, with low-battery drain, resettable by means of a light touch, no noise, and useable in an office environment.

3965 LeRoy W. Farber
Voorhees, NJ

Does anybody have an idea how to build a universal sync generator that will be able to restore vertical and horizontal sync? A schematic and a parts list would be great.

3966 Ernst Faublas
Brooklyn, NY

I do not own a computer. I own several video machines for creating amateur films. Where can I buy a color processor or video device that will enable me to copy a color video tape and make the copy into a black and white tape? I want a device that will let me control the colors.

3967 Sal Favia
Aberdeen Township, NJ

My Radio Shack ET 900, 900 MHz cordless phone, suffers from low volume to second party unless I deliberately talk directly into mouthpiece. The microphone has been changed. It has

done this since new, works well otherwise.

3968 Anonymous

I need help with two (IPS 400 and 600 Elgar) power backups. Both suddenly quit switching to battery power on, power off conditions. Batteries are new and voltage stays up at 28 volts. The first one quit last year, so I got another from ERAC. It quit in eight months. They are flat and fit under the monitor which I really like. I don't want any upright models. (ERAC does not advertise in *Nuts & Volts* anymore.)

3969 G. Schneeweiss
Forrest, IL

A profound hearing loss requires \pm 2 dB output of audio frequencies from 125 to 1,500 Hz. What instruments are available to measure tape deck output at these frequencies?

39610 Carl Stevenson
Monroe, LA

What are your reader's ideas for constructing a transmitter receiver combination, much like a garage door opener that has the following characteristics:

Transmitter: 1) Carried in pocket or purse. 2) Nine-volt battery. 3) Range of 1/2 mile or shorter if a FCC license is required. 4) State-of-the-art and inexpensive. 5) Transmitter signal security code programmed with approximately 1,000 different combinations.

Receiver: 1) Automobile operated by 12 volts. 2) Inconspicuous antenna. 3) One or two outputs to operate a relay or solenoid. 4) Low-power consumption operated when the ignition is off. 5) An auto off when battery voltage is low.

39611 George W. Iwasko
Ontario, NY

My keyboard freezes in Windows 3.1 or is sluggish passing characters to applications like MS Word 6.0 or Excel. It misses characters sometimes. It also returns to operation if you restart Windows or sometimes if you unplug and replug the keyboard at the motherboard while operating. I have tried the obvious, like swapping out keyboard without results. I even swapped keyboard BIOS with an identical replacement. The machine is a 486DLC40 clone, 128K cache, Cyrix 387, FPU 8 meg memory, DOS 6.0, Smartdrv 5.0. How do you start troubleshooting this problem?

39612 George Persico
Thiells, NY

My '87 Nissan Pulsar's low-fuel sensor has quit. Verified by grounding the sensor lead at the gas tank which

lights the indicator lamp. The sensor is not available separately from the dealer, who wants \$245.00 for new fuel pump unit which includes the sensor. It appears to be similar to a thermistor, with low resistance when not immersed in gasoline and high resistance when wet with gas. Can someone suggest a replacement device or put me onto an alternate source?

39613 George Persico
Thiells, NY

I would like information on the connector connections, voltage levels, and signal protocols of the "LANC" connector on the Sony CCD-FX310 Handycam. I have a service manual from Sony entitled "Protocol of Control L/Lf," but it covers the Sony VTR.

39614 Cliff Mueller
Reno, NV

I have a Radius TPD-19 grey-scale monitor that has a "fold-over" on the left portion of the display. I need assistance in getting this monitor repaired. I have removed the diodes in the horizontal area, and they look fine on a VOM. When I originally got this monitor, the horizontal sync was off, and I was able to at least get a stable picture by adjusting the horizontal frequency control (R413).

39615 Mike Schwendeman
Hampton, MN

ANSWERS

ANSWER TO #29618 - FEB. 1996

If you are asking if you can hook a camcorder up to your computer and use its real time output as moving wallpaper, the answer is no. You can, however, purchase a video caption board, hook it to your camcorder, capture some images and save the images as BMP files in the Windows directory. Then go into Windows and set the wallpaper to these newly created BMP files. An easier solution is to buy a 12-exposure roll of 35mm film. Go out and take some pictures you would like as wallpaper. Have them developed on a picture CD-ROM, which is available at many processing locations, and use a graphics file converter utility to change the pictures from whatever format they come in to BMP files. I did this with pictures of my family and converted them to BMP files. I use them as wallpaper and even transmitted them over the Internet to friends!

Paul Stafford
Abilene, TX

ANSWER TO #29622 - FEB. 1996

The fax machine you refer to is most probably a Murata M1200. I've had two of these with the exact same

ANSWER INFO

- Include the question number that appears directly below the question you are responding to.
- Payment of \$25.00 will be paid within four weeks of publication if your answer is printed.
- Only one answer per question will be printed.
- If you do not want your name, address, or phone number available to the reader please so indicate or it will be assumed that you have no objection.
- In the event that more than one person submits the same solution, the choice will be made at the discretion of the publisher.
- Due to space limitations, we can not reprint the original questions with the answer. The question number and the issue it appeared in are printed above the answer.

QUESTION INFO TO BE CONSIDERED FOR PUBLICATION

All questions should relate to one or more of the following:

- 1) Circuit Design
- 2) Electronic Theory
- 3) Problem Solving
- 4) Other Similar Topics

INFORMATION/RESTRICTIONS

- No questions will be accepted that offer equipment for sale or equipment wanted to buy.
- Selected questions will be printed one time on a space available basis.
- Questions may be subject to editing.

HELPFUL HINTS

- Be brief but include all pertinent information. If no one knows what you're asking, you won't get any response (and we probably won't print it either).
- Write legibly (or type). If we can't read it, we'll throw it away.
- Include your Name, Address and Phone Number. Only your name will be published with the question, but we may need to contact you.

symptom as yours. The problem is with the switching power supply located in the back of the unit. I'd be willing to bet that the 5-volt supply is now putting out an unregulated 8 volts. This causes the logic circuits to go berserk turning on all of the indicator lights and activating the audible alert.

Since this seems to be a common failure mode for these machines, I would tend to believe that this is either a design flaw in the power supply or the case of one component being marginally defective. Indeed, I found that it was the same capacitor in both of my

units that had gone bad. Of course, the manufacturer might argue that your machine has operated correctly for over six-eight years — this model was sold around 1988-89 — but that's a different story.

Having a lot of experience in the repair business, I know that many devices have certain parts which are most likely to fail. I'm sure Murata has repaired countless numbers of these units due to this same failure in the power supply. So when my units first failed, I called Murata and talked to one of their service technicians. Although it seemed obvious to me that the technician knew exactly which part had gone bad, he was unwilling to part with this information. In fact, he would not even tell me what voltages the supply was supposed to put out (okay — that's their prerogative; I know they make much of their income on service). Their only suggestion was that the entire power supply could be swapped out at a cost of over \$125.00.

Being a rather low-end model, these machines were not worth spending that much money. However, after a little more time on the bench — without a schematic, mind you — I did trace the problem down to a single electrolytic capacitor. So here's a little gem that should save you \$125.00 (minus 20 cents for the cap): Check C9 on the power supply (you'll probably find it shorted). My notes also indicate that you should take a look at R103 which may have overheated.

Jeff Mazur

ANSWER TO #2966 - FEB. 1996

There is no switching on the motherboard to allow for the higher capacity SIMMs. Simply install the 1 meg SIMMs in lots of four a bank, and boot. If you have a 386SX, a bank is only two SIMMs. One can assure oneself by borrowing a bank of SIMMs and trying them. As an afterthought, the 256K SIMMs are just about worthless. Don't every buy a PC or motherboard with one or two megabytes of RAM; they are usually 256K SIMMs and can't be upgraded without throwing them out.

**Travis Brackeen
St. Louis, MO**

ANSWER TO #29623 - FEB. 1996

A good source of inexpensive software programs is PC SIG 408-730-9291. They are a large, well known distributor of shareware software. A search of their CD produced at least two programs that claim to have voice mail capability. One is MAILBOX by American, Inc. 503-452-8196, and the other is BACKMAIL by Alethic Software, Inc. 902-423-9860. Of course, you will also need a modem. You might want to check your local library, many are now offering access to shareware programs such as PC SIG. The nice thing about the shareware arrangement is that if you try the program, but are dissatisfied, you don't have to pay for it.

**Michael Young
Newville, AL**

ANSWER TO #2963 - FEB. 1996

If you already have the fax modem, then this will be a little complicated. You may be better off letting someone else have your present modem and

buying a new one. There are devices that you can hook on your phone line that will pick it up and switch to either the voice phone or the fax modem. These switches detect the fax tone and switch all non-fax calls to the voice line. Now the gotcha. These devices have to pick up the phone to work. There is then a several second wait (waiting to detect the fax tone) then the phone starts ringing again. Only at this point do you know the phone is ringing. This annoys callers and costs them extra because they start paying long distance charges from the time the switch picks up, and if you don't pick up, they are still charged for the call. This can seriously annoy people.

Now the better solution — a better modem. Your modem may already have this feature, or it may not. Many fax modems have a feature called "silent answer." In this case, the modem listens for a fax tone and picks up the phone when it hears one. You would need a device called a teleprotect which is available from a number of sources including Radio Shack. This device is connected between the phone line and your phone. When you pick up the phone and it is a fax call, the tone sounds and the fax modem takes over. The teleprotect device disconnects your phone from the phone line. This solution really works slick with an answering machine. The fax tones can be a little annoying, but at least it is you instead of your callers/customers that is being annoyed.

**Ray Todd Stevens
Bedford, IN**

ANSWERS TO #2969 - FEB. 1996

Question #1

You may be able to correct the display problem with your monitor without going inside it. Try using the DOS MODE command. It can be used to shift the screen display right or left and to set screen length and width. The command is `MODE[n].m.[T]` where `n` = video mode (40.80.8W80.CO40.CO80.MONO), `m` = R or L shifts display right or left one or two characters and `T` = test pattern for aligning display. It can set screen length and width with the command `MODE CON LINES**L COLS=c` where `L` = 24.43.50 onscreen lines and `c` = 40 or 80 columns per line. Try experimenting with this command and if you find a combination that works, install that command in your `autoexec.bat` so that the monitor display is set each time you boot up.

**Michael Young
Newville, AL**

ANSWER TO #29611 - FEB. 1996

In reference to upgrading a multimedia 486 SX2-66 PC with 4 MB of RAM:

1. To upgrade from 4 meg to 8 meg, I would suggest that you bite the bullet and buy the SIMM modules you need to upgrade your motherboard. If you're not sure what you need, check the system manual that came with your computer or call the company that assembled your computer.

Regarding "RAM Doubling" software (i.e., RAM compression), the industry experts have found that in its present state such software is less than impressive. The March '96 issue

ANSWER TO #2961 - FEB. 1996

The Divisor Latch sets the baud rate for the 8250 (16450 and 16550 also) UART. The Divisor Latch shares ports with the Receive/Transmit Buffer Register, and the Interrupt Enable Register. In order to access the Divisor Latch, one must first set the Divisor Latch Access Bit (DLAB).

which is Bit 7 (Most Significant Bit) in the Line Control Register. Then you may write to the Divisor Latch. After setting the Divisor Latch you must clear the DLAB bit to regain normal access to the UART Receiver Buffer Register (RBR), Transmitter Holding Register (THR), and Interrupt Enable Register (IER).

The place to access the Line Control Register (for DLAB) and the Divisor Latch in a PC Compatible are the specific I/O ports. A single 8250 uses 7 I/O ports. The Divisor Latch will be accessed at the first two ports, and the Line Control Register is at the fourth port on a standard PC.

The standard I/O port addresses for Com1 thru Com4 are as follows:

Com1	03F8H thru 03FEH
Com2	02F8H thru 02FEH
Com3	03E8H thru 03EEH
Com4	02E8H thru 02EEH

A 'C' code example written in Borland (or Turbo) C follows. Some other C compilers may have different names for the `inportb()` and `outportb()` functions which input and output bytes to I/O ports. In BASIC, these functions usually go by the names `INP (port%)` and `OUT port%, data%`. Call this function with your `NewLatchValue` (in your case, `0010H`) to set the baud rate. The I/O ports are referenced off a base address `CBase` which is shown set for Com1 and which may be modified for other Com ports.

```
#include <dos.h>
```

```
void SetBaud(unsigned NewLatchValue)
```

```
{
    unsigned char D1;          /* Temporary storage */
    unsigned char LCR;         /* LineControlRegister; access DLAB here */
    unsigned char DL_LSB;     /* I/O port for DivisorLatch_LeastSignificantByte */
    unsigned char DL_MSB;     /* I/O port for DivisorLatch_MostSignificantByte */
    unsigned char BCH;        /* Value for DivisorLatch, MSB */
    unsigned char BCL;        /* Value for DivisorLatch, LSB */
```

```
/* The following #define sets the base I/O base address for Com1 */
/* Substitute 0x2F8 for Com2, 0x3E8 for Com3, 0x2E8 for Com4 */
#define CBase 0x3F8
```

```
DL_LSB = CBase;
DL_MSB = CBase + 1;
LCR = CBase + 3;
```

```
BCH = NewLatchValue / 256;
BCL = NewLatchValue % 256; /* % is Modulo or Remainder */
```

```
D1 = inportb(LCR);          /* Set DLAB=1 */
D1 = D1 | 0x80;             /* to access DivisorLatch */
outportb(LCR,D1);           /* of the 8250 */
```

```
outportb(DL_MSB,BCH);       /* Set Baud Rate MSB */
outportb(DL_LSB,BCL);       /* Set Baud Rate LSB */
```

```
D1 = inportb(LCR);          /* Set DLAB=0 */
D1 = D1 & 0x7F;             /* for normal access to RBR, THR and IER */
outportb(LCR,D1);           /* of the 8250 */
}
```

A good reference for the UART information is *DataCommunications Local Area Networks UARTs Handbook* (the book with the data sheets for the 8250 etc.). Published by National Semiconductor Corp.

An interesting book which contains some good references to communications is *Mastering Turbo Assembler*. Published by Howard W. Sams.

I/O ports are described in detail in the book *Interfacing to the Personal Computer*, which is also published by Howard W. Sams.

**Todd Schifferdecker
Belleville, IL**

of *Windows Magazine* reviewed Soft RAM, RAM Doubler, and MagnaRAM. All three software products reported that RAM was increased, but none of the machines showed any speed increases or reduction in disk activity which would be evident if the RAM were, in fact, increased. All three also showed various incompatibilities with Windows 95.

Even though buying the SIMM modules is a bit more expensive, you won't be throwing your money away. If you put 8 meg in it, you'll get 8 meg out of it without the inconsistencies, incom-

patibilities, or bogging the processor with additional tasks like compressing and decompressing RAM.

2. Regarding buying a six-function multifunction printer, fax, copier, etc. device versus buying a color bubble-jet is really personal preference. The question of buying black and white versus color is an easy one. For what it costs (ink-jet, of course) hands down go color; you'll be glad you did.

As far as the multifunction device versus just purchasing a printer goes, a multifunction device is nice because

Continued on page 118

PRO-FILTERS AS LOW AS \$8.25 (dealers) FOR THESE UNITS:

FTG, VE, RFT 1 & 2, T-ONE, GENESIS MORPHING & ALL OTHERS.

Also Available:

TVT-G • PIO-6300 • PIO-GREEN • PIO+ • STEALTH 1000-P • STEALTH 80-P
• M-80 • SA-3 • APOLLO-J • PURPLES • TNT+PIO • & MORE

CONVERTERS:

PANASONIC TZPC1453G2 • TPI 550 • & MORE
BOSS UNITS & OTHERS

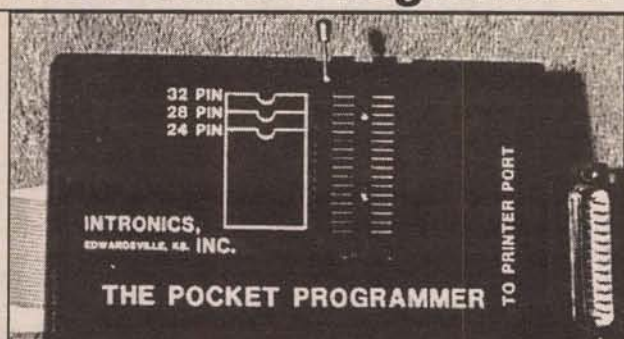
PLAZAC SALES, INC.

1-800-A-WIRE-4U (1-800-294-7348)

Sorry No New Jersey Sales
Call Mon.-Fri. 10-7 EST & Sat. 10-3

Write in 48 on Reader Service Card.

The Pocket Programmer



The portable programmer that uses the printer port of your PC instead of a internal card. Easy to use software that programs E(E)prom, Flash & Dallas Ram. 27(C)/28(C)/28F/ 29F/29CXXX & 25XX series from 16K to 8 Megabit with a 32 pin socket. Adapters available for Pic, MCU's 874X, 875X, 40-Pin X 16 & Serial Eprom's, PLCC, 5-Gang and Eprom Emulator to 32K X 8. **Only \$129.95**

Same Name, Address & Phone Number for 13 Years.....
Now isn't that Amazing ?

Intronics, Inc.

Box 13723 / 612 Newton St.

Edwardsville, KS 66113

Tel. (913) 422-2094

Fax (913) 441-1623

Add \$4.75 COD

Add \$4.00 Shipping

Visa / Master Charge

ACP's 72nd GIANT COMPUTER SWAP★MEET

Orange
County's
Original!

Be a
Seller!
...for
space
call
Mary...

Sunday, 8am-2pm
Mar 31st

FREE Admission & Parking
Shop 100's of Sellers

in ACP's Giant Parking Lot

Advanced Computer Products, Inc.

ACP SUPER★STORE

Since 1976

1310 E. Edinger
Santa Ana, CA
714-558-8813

SECURITY cont.

STUN BATON or high voltage ozone replenisher, \$30 plus \$3.90 shipping each. Knight Industries, Box 1525, Woodinville, WA 98072, 206-481-9491. Knight Sticks are personal, non-lethal, high voltage defense products direct from manufacturer, us!

SPY EMPORIUM privacy security. Professional recorders, parabolic mic., wireless covert video, bugging/phone tap detectors, scramblers, locksmith tools, etc. FOR CATALOG, SEND \$5 to Security Trade, 6065 Hillcroft, Suite 413, Houston, TX 77081. 713-774-1000, FAX 713-774-6222.

TIME-LAPSE VCR, Panasonic NV-8030. These are low time, used, 1/2" reel-to-reel machines, but will record 108 hours on a single tape. Ideal for security applications. Price \$100 as-is, \$150 with new rewind drive wheel installed. Service manual \$30. Detection Dynamics, 512-926-8811, FAX 512-926-0940.

CCTV LENSES, new & used stuff, all sizes, 2-8-75mm, man-auto iris \$10 up. Lot prices. 617-933-0827.

PAGER OWNERS! Use your pager as a security monitor to monitor your burglar alarm and telephone answering machine using **Pageout** automatic paging system. Save money. Sells for \$99.99. Volume purchasing \$69.99. Call 410-483-6211.

STOP INVASIVE bugs! Vibrating pocket RF detector silently alerts you to weakest of transmitters. Smallest design ever! Build entire RF-vibe for under \$20. Send long SASE for free brochure. DE Newkirk, PO Box 17277, N. Little Rock, AR 72117-0277 USA.

VIDEO TRANSMITTER and receiver, 2.4GHz, FM video and audio, 300 feet range, 4 channels, AC adapter and cables included. **\$175 + S&H**, CCD camera & battery pack available. Aljon Technologies, 310-793-1788.

HIDDEN BUG MIC IN PEN OR AC OUTLET! FINAL INVENTORY CLOSEOUT SALE (only 2,000 in stock). **WHOLESALE \$25 PPD.** Buy 4, get 5th FREE! (Regular wholesale \$79). Order today, last chance: **BRINKER ENGINEERING LABS**, Suite 124-A, Box 348, Ellaville, GA 31806-0348.



SURVEILLANCE: ALL ELECTRONICS SECURITY DEVICES AND ALL YOU NEED FOR PRIVACY AND SECURITY, BUGGING/PHONE TAPPING DETECTORS, TELEPHONE RECORDING, TELEPHONE/FAX SCRAMBLERS, VEHICLE TRACKING SYSTEM, COVERT VIDEO CAMERA, TRANSMITTER KITS, AND MORE. FULL CATALOG AVAILABLE. **A.B. ELECTRONICS**, NY, 1-800-U-ANTIBUG, 718-253-3637.

REWARD! We buy used surveillance equipment. Top prices paid. Call 212-396-1111 or Fax 212-396-9376.

CCTV SANYO CCD Cams 8mm lens w/12V PS \$100 ea. Covert cameras, smoke alarm cam. \$125 ea. Outdoor secur. lite w/hidden cam. \$150. Quantities of fiber optic CCTV equip & video motion detectors. Call for list 617-933-0827.

BURGLAR ALARM EQUIPMENT. New and used. Magnetic contacts, installation tools, control panels. Request list. Detection Dynamics, 512-926-8811, FAX 512-926-0940.

SATELLITE EQUIPMENT

PROGRAMMERS BY AMS, TRIBAL & XELTEK E(P)ROMS, Flash, GALs/ micros \$125 up. Systems including PICs & erasers. 24 hr. FREE BBS updates for clients. **History: 24 yrs. client satisfaction.** **TRIANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390. M-F 9am to 2pm EST.



RCA DIGITAL SATELLITE SYSTEM (DSS). Experimenters files and schematics, source code, binary files, and software tools for experimenting with the European VideoCrypt System. Will it work on the USA DSS System? \$29.95 postpaid. **VISA/MC** 520-782-2316. **TELECODE**, Box 6426-NV, Yuma, AZ 85366-6426.

SATELLITE RADIO BOOK AND GUIDE. New book covers all Audio Services, SPCP, Subcarriers, FM Squared, Facsimile, Press Services, Weather Services. Simple how-to-receive instructions. \$16.95 plus \$3 Priority Mail. **UNIVERSAL ELECTRONICS**, 4555 GROVES ROAD, #12, COLUMBUS, OH 43232. 614-866-4605.

SATELLITE DISH MOTORIZED MOUNT, Horizon 180, new! 24VDC motor, limit switches, 10 counts per degree. \$100 ea. 2/\$180 plus shipping. 63# UPS shippable. Call Roger @ GS&E, 716-338-7001. Visa, MC, Discover.



25K LNB \$54.95, 20K LNB \$69.95, complete systems, C/KU, RCA, DSS 18", Orbitron, Ajak, Drake, Chaparral, Echostar, HTS, Accessories, expert advice. Free catalog. Satellite Warehouse. 1-800-851-6534.

SUBSCRIBE TO the North Star Gazer, your satellite industry news connection. Published monthly, geared at the satellite industry professional & enthusiast. We offer industry-related news items on C-Band, KU-Band, & DBS, technical tips, charts & graphs, reference materials, unique editorials, product reviews, installation tips, full reports on the happenings in the satellite underground, events calendar & much, much more! \$48 per year. Send check today to: North Star, PO Box 1023, Lapeer, MI 48446. 810-664-4022. Visa, MasterCard, American Express accepted.

SATELLITE SYSTEM upgrade. We have new 30 degree or better LNBs. Brand name 2 year warranty for \$39 ea. Takes 10 min. to change. We ship UPS collect. Com/Way, PO Box 1729, Alamogordo, NM 88310. Ph 505-437-7575.

NOW FOR VCII PLUS 029 and RS SYSTEMS SureWrit 9™ PLUS DEVELOPMENT DEVICE. For hackers only, who like to study VCII Plus PPV & repair old VCII's. End sports blackouts. Send SASE for features of SW9 system. Update kits for old SW9 to RS are now available! **TRIANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390. M-F 9am to 2pm EST.

VIDEOCYEPHER II descrambling manual. Schematics, video, and audio. Explains DES, EPROM, CloneMaster, Pay-per-view (HBO, Cinemax, Showtime, Adult, etc.) \$16.95, \$2 postage. Schematics for Videocypher Plus \$20. Schematics for Videocypher 032, \$15. Collection of software to copy and alter EPROM codes, \$25. VCII Plus EPROM, binary and source code \$30. Cabletronics, Box 30502N, Bethesda, MD 20824.

DSS TEST Card for information on how to improve the performance of your DSS system. Send a SASE to Test Consultants, 103 N. Wood Ave., Suite 50, Linden, NJ 07036 or call 908-382-8688.

SYNC-A-LINK UNIVERSAL VIDEO SYNC GENERATOR is an educational troubleshooting tool for those persons seeking technical support for evaluating different types of video difficulties. It will restore all horizontal & vertical sync lines from standard or distorted analogue video-type formats. It requires pretuned baseband video, and comes complete with operations manual & 90-day warranty. Total package case with power pack completely assembled, aligned, tested, \$150. Voice orders and information 918-479-6451 or write to Sync-A-Link Communications, PO Box 4, Locust Grove, OK 74352.

ALL ELECTRONICS

C O R P O R A T I O N

QUALITY PARTS

FAST SHIPPING

DISCOUNT PRICING

CALL, WRITE, FAX or E-MAIL For A Free 64 Page CATALOG. Outside the U.S.A. send \$2.00 postage.

PHOTOVOLTAIC DETECTOR

Miniature silicon solar cell converts light impulses directly into electrical charges. Unlike a conventional photo diode or transistor, it generates its own power and does not require any external bias. Generates 0.4 vdc in moderate light. Silicon cell is mounted on a 0.31" x 0.23" x 0.07" thick plastic carrier and has pc leads on 0.2" centers. Large quantity available. **CAT # PVD-2**

75¢ 10 for \$6.50 • 100 for \$50.00

Great Price! 800 MA UNIVERSAL WALL ADAPTOR

Multi-voltage power source eliminates the use of batteries in many electronic products. This handy device has 6 voltage settings between 3 and 12 Vdc. Universal power plugs fit almost every product. Polarity switch. UL and CSA listed. **CAT # MOA-800**

\$9.50 each

"CLAM SHELL" CELLULAR CONTROL HEAD MOUNTING KIT

The "Clam Shell" kit is designed for mounting a cellular phone control head in a vehicle. It will work well for mounting many kinds of communications or audio equipment in cars or elsewhere. Made of heavy-gauge steel, featuring a full 180 degree tilt, a pre-drilled top plate with threaded holes that fit a majority of cellular control heads, it includes complete mounting hardware. **CAT # CMT-2**

\$2.50 each

RECHARGEABLE BATTERY 12 VOLTS 9 A/H

Rechargeable lead acid battery. Prepped for use in a product which hasn't yet come to market. They are 5.9" x 2.55" x 4.42" high and have a strip of foam padding stuck to one side. They have standard 1/4" quick-connect/ solder terminals. Weight: 8 lbs. **CAT # GC-129**

\$28.50 each 8 for \$208.00

7 RELAYS, 4 VOLTAGE REGULATORS (and lots of other good stuff)

This pc board was a telephone line-sharing switch. A great source of cheap parts. On it you will find 3 LM317T voltage regulators, 1 LM340T-5 regulator with heatsink, 2 crystals, seven relays, a power transformer, a 600 ohm coupling transformer and at least 50 other parts. The voltage regulators alone are worth \$5.00. Check it out! **CAT # EX-1218**

\$3.50 each

SUB-MINIATURE SNAP ACTION SWITCH

CHERRY DG1C-BJ07 S.P.D.T. Body size: 0.51" long X 0.255" high X 0.255" wide. Lever with ridged end simulates roller action. Rated 3 amps @ 125 Vac, 2 amps @ 30 Vdc. PC pins on 0.2" centers. Large quantity available. **CAT# SMS-133**

2 for \$1.00 100 for \$45.00 1000 for \$350.00

SUPER SAVINGS ON S-VHS TAPES (USED)

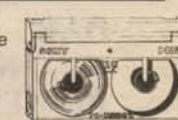


Super VHS tape users! Save a bundle on name-brand S-VHS, T-120 tapes. These tapes were used for a brief period, then bulk erased. The record-protect tabs have been broken out, so you will have to cover the notch with a piece of tape, but they work great and cost a fraction of the "new" price. Try some, you'll be back for more.

CAT #S-VHS **\$3.00** each 10 for \$28.00 • 100 for \$250.00

"HI-8" VIDEO CASSETTE (USED)

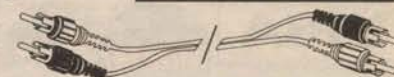
SONY HI-8 Top quality, metal particle 120 minute video cassettes. Used for a short time, then bulk-erased. Each cassette has its own plastic storage box. Satisfaction Guaranteed. **CAT # VCU-8**



\$3.00 each

10 for \$28.00 • 100 for \$250.00

LARGE QUANTITY AVAILABLE! 9 FOOT DUAL AUDIO CABLE



9' shielded dual audio cable with color coded (red and yellow) RCA style pin plugs either end. Black cable. **\$1.00** each **CAT# DCB-108**

10 for \$8.50 • 100 for \$75.00 1000 for \$500.00

ORDER TOLL FREE

1-800-826-5432

MAIL ORDERS TO:
ALL ELECTRONICS CORP.
P.O. BOX 567
VAN NUYS, CA 91408-0567

FAX (818) 781-2653 • INFO (818) 904-0524
<http://www.allcorp.com/>
E-MAIL allcorp@allcorp.com

NO MINIMUM ORDER • All Orders Can Be Charged to Visa, Mastercard, American Express or Discover • Checks and Money Orders Accepted by Mail • Orders Delivered in the State of California must include California State Sales Tax • NO C.O.D. • Shipping and Handling \$5.00 for the 48 Continental United States - ALL OTHERS including Alaska, Hawaii, P.R. and Canada Must Pay Full Shipping • Quantities Limited • Prices Subject to change without notice.

MANUFACTURERS - We Purchase EXCESS INVENTORIES... Call, Write or Fax YOUR LIST.

TONY TALLI'S ORIGINAL *SINCE* 1984

TELEVIEW DISTRIBUTORS



WHERE OUR VALUED CUSTOMERS' BUSINESS
IS HONESTLY APPRECIATED

1 • 800 • 847 • 3773



VEGA ONE ORDERS ALSO ACCEPTED

1 • 800 • 525 • 0428 P.M. SALES



90 DAY + GUARANTEE

NO PERSONAL CHECKS
U.P.S. INSURED

PRICES EFFECTIVE MARCH 1996

NO NEVADA SALES
HOURS: M-F 9-4 PST

	PAN	COMBO		PAN	COMBO
NEW B3	\$50.00	\$110.00	SCI.ATL.		
TRI BI	\$65.00	\$125.00	8500 to	\$55.00	\$120.00
FAST TRI BI	\$90.00	\$150.00	8569		
HAMLIN			8570 to		\$175.00
MLD	\$50.00	\$110.00	8580		
OAK			YES ZENITH		
N12VS	\$50.00	\$110.00	YES BASEBAND BB		
PIONEER			ORDERS CALLED IN BY 1:00		
BA5135	\$75.00	\$135.00	SHIPPED SAME DAY		
BA1200	\$75.00	\$135.00	\$15.00 Shipping		
BA6110	\$130.00	\$190.00			
BA6150		\$175.00			



Nuts & Volts March Special
SSA86 \$160.00

GIVE TELEVIEW TONY A CALL TODAY

1-702-253-1852 • FAX 1-702-253-1854 • P.O. BOX 71465 • LAS VEGAS, NV 89170-1465

**Tony Talli's Original Teleview is not affiliated with Teleview, Inc. NV Corp.
or Teleview Distributors, Inc. of Illinois.**

☐ Yes, I am paying for full service, this unit is only to be used as an extra unit.

WAIVER

1. **WARNING:** The ownership of a cable decoder DOES NOT give the owners of the decoder the right to decode or view premium cable channels without AUTHORIZATION from their cable company.
2. **AUTHORIZATION:** In general terms, proof of payment to a cable company for viewing their premium channels is AUTHORIZATION. I, the undersigned, understand paragraphs 1 and 2 above and agree that: **AS A USER:** I will not use any cable products purchased from Teleview Distributors by myself or my company, for the purpose of decoding or viewing unauthorized premium cable channels or avoiding rightful payment to any cable company. **AS A SELLER:** I will not sell, trade, give or dispose of any goods I have purchased from Teleview Distributors to any third party or customer to whom I know, believe or suspect of using said goods for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company. **AS AN ADVERTISER:** I agree I will not advertise, tell or communicate to anyone in any manner, that products I have purchased from Teleview Distributors can be, should be or are intended to be used for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company.

Signature _____

Date _____



PLEASE FOR ORDERS ONLY

1-800-742-2567

**P.O. BOX 538
BENSENVILLE, IL 60106**

Call 708 • 616-8050 or Fax 708 • 616-8094

*** SSA-86-1 pc. (Scientific Atlanta, Pioneer) . . . \$160.00**

Starbase B3	\$50.00	85 Ch. Converter w/Remote & Volume . . .	\$ 85.00
ED+ (TVT-3G)	65.00	B3 Combo	110.00
Scientific Atlanta SA-3B	55.00	ED+ Combo	125.00
SA-4 (8580)	100.00	SA-3B Combo	120.00
Pioneer SMod (6100)	120.00	SA-4 Combo (8580)	165.00
Pioneer+	75.00	* FTB 312 Combo	150.00
Oak N12	50.00	Pioneer SMod Combo (6100)	180.00
Hamlin MLD 1200	50.00	Pioneer Combo	135.00
* FTB 312	90.00	Oak N12 Combo	110.00
85 Ch. Converter w/Remote	65.00	Hamlin MLD 1200 Combo	110.00

★ASK ABOUT THE NEW MILLENNIUM 3★

★WE NOW SHIP FED-EX★ 1-800-742-2567 FOR ORDERS ONLY

Hours: Mon.-Fri. 8-6 CST Sat. 10-2 CST

★SIX-MONTH GUARANTEE (30-DAY MONEY BACK)★

QTY.	ITEM	OUTPUT CHANNEL	PRICE EACH	TOTAL PRICE
			SUBTOTAL	
			HANDLING ADD 5%	
			SHIPPING ADD \$7.00 PER UNIT	
			TOTAL	

**SHIPPING + HANDLING CHARGES NON-REFUNDABLE
NO PERSONAL CHECKS — NO ILLINOIS SALES
Cashier's Check • Money Order • COD • VISA • MC
SPECIAL SHIPPING RATE ON 5 & 10 LOT ORDERS
VISA ☐ MASTERCARD ☐**

PLEASE PRINT **CARD #** **EXP. DATE**

Name _____

Address _____

City _____ State _____

Zip _____ Phone No. () _____

It is not the intent of Greenleaf Electronics to defraud any pay television operator and we will not assist any company or individual in doing the same.

THIS FORM MUST BE SIGNED AND SENT BACK TO INSURE GUARANTEE

WAIVER

☐ Yes, I am paying for full service, this unit is only to be used as an extra unit.

1. WARNING: The ownership of a cable decoder DOES NOT give the owners of the decoder the right to decode or view premium cable channels without AUTHORIZATION from their cable company.

2. AUTHORIZATION: In general terms, proof of payment to a cable company for viewing their premium channels is AUTHORIZATION.

I, the undersigned, understand paragraphs 1 and 2 above and agree that:

AS A USER: I will not use any cable products purchased from Greenleaf by myself or my company, for the purpose of decoding or viewing unauthorized premium cable channels or avoiding rightful payment to any cable company.

AS A SELLER: I will not sell, trade, give or dispose of any goods I have purchased from Greenleaf to any third party or customer to whom I know, believe or suspect of using said goods for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company.

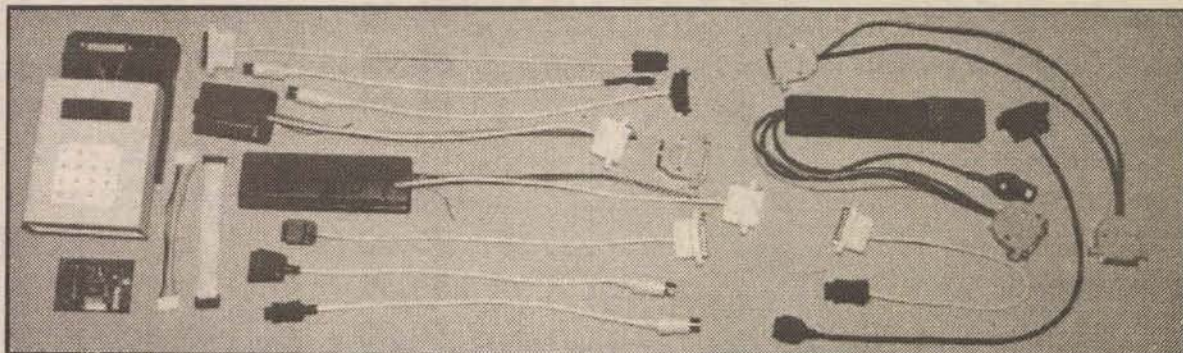
AS AN ADVERTISER: I agree I will not advertise, tell or communicate to anyone in any manner, that products I have purchased from Greenleaf can be, should be or are intended to be used for the purpose of decoding unauthorized premium cable channels or avoiding rightful payment to any cable company.

Signature: _____ Date: _____

CELLULAR PROGRAMMING KITS!

BUILD YOUR OWN AND SAVE THOUSANDS

COMPLETELY MOBILE... STAND
ALONE... BATTERY POWERED...
IDEAL FOR PROGRAMMING NEW,
RENTAL OR LOANERS... EASY TO
OPERATE... PROMPTS USER...
SETS CLONED PHONES BACK TO
ORIGINAL ESN...EASY UPGRADES
TO NEW SOFTWARE...



<u>KIT #</u>	<u>PROGRAMS THE FOLLOWING PHONES</u>	<u>PRICE</u>
1	<u>MOTOROLA ONLY</u> w/elite & 951C	\$1995
2	Above PLUS <u>NEC</u> P100-200-300-400-600-700	\$2195
3	All of above PLUS <u>SONY</u>	\$2395
4	All of above PLUS <u>GE</u> (old & new mode)	\$2595
5	All of above PLUS <u>AUDIOVOX</u> (does new 800!)	\$2795
6	All of above PLUS <u>MITSUBISHI/DiamonTel</u>	\$2995

All Kits are COMPLETE with cables...SIMPLE, detailed assembly instructions....Assembles in MINUTES.... EASY to understand operational instructions....PLUS technical support!

OTHER ITEMS OF INTEREST

- MOTOROLA programming cables (flips, bricks, mob/bags, ultraclassic) \$195
- LOADER PHONE (cables included) \$599
- G2 Program (includes AMPS) \$ 99
- NEW NEC P100 programmed to your existing number \$225
- NEW MOTOROLA FLIP programmed to your existing number \$279
- AUDIOVOX mobile/transportable programming kit with cables CALL
- Extension phone programming (proof of service required) from \$ 79
- Repair and upgrades for "Copy Cat", "Black Boxes", etc., available CALL

ABOUT US

Midnight Communications (a division of Cellular Technology Group) was one of the first importers/distributors of the "stand alone" programmer (i.e. "black box", "copy cat", "kopy cat", etc..) and has sold them to many others for distribution. Up to now, because of middlemen and huge markups, the cost of stand alone programmers has been prohibitive and out of reach of the average cellular agent. Now Midnight Communications is offering our stand alone programmers direct to you in easy to assembly kit form at an affordable price. WE ARE PARTICIPANTS IN THE BBB's CARE PROGRAM AND DO NOT OPERATE OUT OF A LETTER SUITE OR USE A P.O. BOX. You are invited to call or visit us at 2170 Roswell Road, Marietta (Atlanta) GA. 30062. Purchaser of any kit agrees to comply with all local, state and federal laws, including all FCC rules and regulations. All kits are sold for EDUCATIONAL PURPOSES ONLY.

CALL US TODAY AT 770.973.8474 or e-mail ctg@mindspring.com

RESOURCE BIN

number fifty

Injection molding and plastic prototyping

Our usual reminder here that the *Resource Bin* is now a two-way column. You can get tech help, consultant referrals, and off-the-wall networking on nearly any electronic, *tinaja* questing, personal publishing, money machine, or computer topic by calling me at (520) 428-4073 weekdays 8-5 Mountain Standard Time.

A portion of my PSRT RoundTable on *GENIE* has also been set aside for you *Nuts & Volts* readers. This is the place you go for instant tech answers. Among the many files in our library, you will find complete reprints for all the *Resource Bin* columns.

GENIE is under new owners. It now offers lower rates, plus a direct flat fee full Internet access.

See the trailer blurb for details.

Plastics and Polymers

I sure do get a lot of helpline calls that concern plastics in one way or another. Maybe as a custom part for a project. Or for fancier cases. Or to create unique packaging or effective presentations. Or to explore several new desktop publishing options.

Nearly all of the plastics industry does appear to be snotty and inbred. You will often find steep minimums, arrogant resellers, unanswered calls, and insanely high set-up charges. Even finding suppliers can be a real bear.

The reasons for these hassles are simple: Plastics form a high-volume industry. Onesie-twosies can end up more trouble than they are worth.

The term "custom" means different things to different outfits. One blow molder I tried working with defined "custom" as "On our regulation one gallon milk container, do you want a green or a blue cap?" Their minimum order was two million units.

When I tried to sort all my plastics resources out, I was utterly amazed at how big the pile ended up. Let's see if we can't rearrange it ...

The Usual Suspects

There's zillions of different plastic options out there today. These vary

in cost, strength, and flexibility. Picking the wrong plastic for any ap is bound to cause you grief. Here's some of the more popular candidates ...

ABS is a durable family of plastics used for everything from water pipes to ads. Foam core expanded versions make light and rigid displays. The typical brands are *Sintra* and *Kydex*. A solid textured version is *Royalite*.

Acrylic is a low-cost and somewhat brittle plastic that can offer extreme clarity. *Plexiglass* is one trade name for the thicker sheets. It's available in many colors and patterns. *Plexiglass* is easily cut by scoring and snapping. It is also easily heat-formable.

Butyrate is a clear and modestly flexible plastic. It is mainly used for mailing tubes and point-of-purchase parts containers. These cut easily with plain old scissors.

Delrin is one brand name for acetal, a versatile engineering and structural plastic. It often outperforms

**NEXT TIME:
Don takes a second look
at some solar winners
and losers.**

nylon at a modest cost premium. This can be turned, milled, or otherwise cut up by using normal shop tools.

Fiberglass is a misnomer. Instead, you really have an epoxy or polyester plastic resin that has been reinforced using glass fiber mats. Boats, flexible antennas, and printed circuit boards are three important uses.

Mylar is one name for a polyester plastic. It is very dimensionally stable and extremely strong in thin films. An older use is recording tape. The Mylar sheets have good temp resistance and may safely be sent on through a laser printer. Mylar also mirrorizes quite well. For decorative or solar aps.

Nomex is a stable plastic with very high temperature capabilities. It even gets used for fire suits. Although its typical electrical properties are very good above a critical

high temp, it chars and can become a conductor. *Kapton* is a related brand name.

Nylon is a common and a highly useful engineering thermoplastic. It is easy to machine, quite stable, and can make excellent bearings. It injection-molds beautifully. This one is often your best all around choice for many mechanical and support parts.

Phenolic is an older, quite brittle thermosetting plastic. Your available colors are brown, brown, and brown. It has real good electrical properties and reasonable temp performance. It cracks fairly easily.

Polycarbonate is a very tough and clear replacement for acrylic. Lexan is one brand. "Bulletproof" windows are one use. The standard sizes used for windows are often cheapest.

Polypropylene is just a variation on polyethylene that offers incredible flexibility. "Living hinge" applications are found on everything from car gas pedals to file card holders. It is very difficult to bond.

Polyethylene is a very flexible and slippery low-cost plastic. It gets used for lots of items from food bowls to adhesives. Ziploc shipping bags and construction films are two of the high-volume uses. Linear polyethylene is an improved and stronger product.

Polystyrene is an improved form of styrene. It can be very clear and has quite good high-frequency electrical properties. But it is brittle and has a very low melting point. Do beware of using soldering irons or solvents near polystyrene capacitors!

PVC is short for *poly vinyl chloride*. You'll see some members as the thick gray slabs in printed circuit etchers, as thin films in vinyl page protectors, or as a plain old black plastic sewer pipe. It has good resistance to most chemicals and heat forms beautifully. PVC can also be welded with a heat gun and a PVC rod.

Styrene is an economic, but brittle plastic. It is also made in light foams or expandable beads. When you heat these, they will expand into a mold to create your classic beer cooler or such. A hot wire cutter is one easy way to work with these materials. Make your own by smashing a power resistor to get some nichrome wire.

Teflon is but one tradename for a fluorinated hydrocarbon. Featuring extreme surface slip and outstanding chemical resistance. Although a lot cheaper than before, teflon is still very expensive for most aps. It is normally reserved for "Uh, compared to what?" uses. And then only sparingly.

Tyvec. Whoever invented this one should get chopped up and fed to the cows. The "paper" replacement made from ground-up polypropylene fibers, it makes for totally impossible to open packages; envelopes that

new from
DON LANCASTER

ACTIVE FILTER COOKBOOK

The sixteenth (!) printing of Don's bible on analog op-amp lowpass, bandpass, and highpass active filters. De-mystified instant designs. \$28.50

CMOS AND TTL COOKBOOKS

Millions of copies in print worldwide. THE two books for digital integrated circuit fundamentals. About as hands-on as you can get. \$28.50 each.

INCREDIBLE SECRET MONEY MACHINE II

Updated 2nd edition of Don's classic on setting up your own technical or craft venture. \$18.50

LANCASTER CLASSICS LIBRARY

Don's best early stuff at a bargain price. Includes the CMOS Cookbook, The TTL Cookbook, Active Filter Cookbook, PostScript video, Case Against Patents, Incredible Secret Money Machine II, and Hardware Hacker II reprints. \$119.50

LOTS OF OTHER GOODIES

Ask the Guru I or II or III	\$24.50
Hardware Hacker II, III or IV	\$24.50
Micro Cookbook I	\$19.50
PostScript Beginner Stuff	\$29.50
PostScript Show and Tell	\$29.50
Intro to PostScript Video	\$29.50
PostScript Reference II	\$32.50
PostScript Tutorial/Cookbook	\$19.50
PostScript by Example	\$31.50
Understanding PS Programming	\$29.50
PostScript: A Visual Approach	\$22.50
PostScript Program Design	\$24.50
Thinking in PostScript	\$22.50
LaserWriter Reference	\$19.50
Type 1 Font Format	\$16.50
Acrobat Reference	\$24.50
Whole works (all PostScript)	\$380.00
Synergetics Surplus Catalog	FREE
Technical Insider Secrets	FREE

POSTSCRIPT SECRETS

A Book/Disk combination crammed full of free fonts, insider resources, utilities, publications, workarounds, fontgrabbing, more. For most any PostScript printer. Mac or PC format. \$29.50

BOOK-ON-DEMAND PUB KIT

Ongoing details on Book-on-demand publishing, a new method of producing books only when and as ordered. Reprints, sources, samples. \$39.50

THE CASE AGAINST PATENTS

For most individuals, patents are virtually certain to result in a net loss of sanity, energy, time, and money. This new reprint set shows you tested and proven real-world alternatives. 28.50

BLATANT OPPORTUNIST I

The reprints from all Don's Midnight Engineering columns. Includes a broad range of real world, proven coverage on small scale technical startup ventures. Stuff you can use right now. \$24.50

RESOURCE BIN I

A complete collection of all Don's Nuts & Volts columns to date, including a new index and his master names and numbers list. \$24.50

FREE SAMPLES

Well, nearly free anyway. Almost. Do join us on *GENIE* PSRT to sample all of the Guru's goodies. The downloading cost on a typical Guru file is 21 cents. Modem access: Dial (800) 638-8369. On prompt, JOINGENIE, then DMD524 on key.

FREE VOICE HELPLINE VISA/MC

SYNERGETICS
Box 809-NV
Thatcher, AZ 85552
(520) 428-4073

Write in 154 on Reader Service Card.

RESOURCE BIN

PLASTICS RESOURCES

Adhesives & Sealants PO Box 400 Flossmoor IL 60422 (708) 922-0761	Circuits Manufacturing 500 Howard St San Francisco CA 94105 (415) 397-1881	Ellsworth Adhesives 1610 N I-35 Ste 208 Carrollton TX 75006 (214) 446-8000	Kepron Circuit Systems 630 Axminster Dr Fenton MO 63026 (800) 325-3878	Pitsco 1004 East Adams Pittsburg KS 66762 (800) 835-0686	Small Parts PO Box 4650 Miami Lakes FL 33014 (305) 557-8222
AIN Plastics 249 E Sandford Blvd Mt Vernon NY 10550 (914) 668-6800	Coburn Corp 1650 Corporate Rd Lakewood NJ 08701 (201) 367-5511	Evergreen Scale Models 12808 NE 125th Way Kirkland WA 98034 (206) 823-0458	Lindsay Publications PO Box 538 Bradley IL 60915 (815) 935-5353	Polytek Development 55 Hilton Street Easton PA 18042 (610) 559-8620	Special Effects Supply 534 W 100 N #3 Bountiful UT 84010 (801) 298-9762
American Science & Surplus 3605 Howard St Skokie IL 60076 (708) 982-0870	Converting 301 Gibraltar Dr Morris Plains NJ 07950 (201) 292-5100	Film & Video 8455 Beverly Blvd #508 Los Angeles CA 90048 (213) 653-8053	Master Bond 154 Hobart St Hackensack NJ 07601 (201) 343-8983	P-O-P & Sign Design 7400 Skokie Blvd Skokie IL 60077 (708) 675-7400	Stephens Products 128 N Park Street E Orange NJ 07017 (201) 672-2140
Associated Bag Co 400 W Boden St Milwaukee WI 53207 (800) 926-6100	Delvies Plastics 133 W Haven Ave Salt Lake City UT 84165 (800) 533-5843	Garden Fresh Replicas PO Box 208 Neosho MO 64850 (800) 545-7304	Model Railroad 21027 Crossroads Cir Waukesha WI 53187 (414) 796-8776	Rogers 5750 E McKellips Road Mesa AZ 85205 (602) 830-3370	Stratasys 14950 Martin Dr Eden Prairie MN 55344 (612) 937-3000
Cadillac Plastics PO Box 7035 Troy MI 48007 (800) 468-1200	Design Toscano 17 E Campbell St Arlington Heights IL 60005 (800) 525-0733	Gerber Scientific 83 Gerber Rd S Windsor CT 06074 (203) 644-1551	Modern Plastics 1221 Sixth Avenue New York NY 10020 (212) 512-6242	Rohm & Haas Independence Mall W Philadelphia PA 19105 (215) 592-3000	Synergetics Box 809 Thatcher AZ 85552 (520) 428-4073
Caplugs 2150 Elmwood Ave Buffalo NY 14207 (716) 876-9855	Devcon 30 Endicott St Danvers MA 01923 (508) 777-1100	Haygeman Machine 2225 S 170th St New Berlin WI 53151 (414) 797-7520	Morgan Industries 3311 E 59th Street Long Beach CA 90805 (800) 222-6929	School Shop Box 8623 Ann Arbor MI 48107 (313) 769-1211	3D Systems 26081 Ave Hall Valencia CA 91355 (805) 295-5600
Catalina Plastics 23901 Calabasas Rd Calabasas CA 91302 (800) 333-3136	Dow Corning PO Box 994 Midland MI 48686 (517) 496-4000	IASCO 5724 W 36th St Minneapolis MN 55418 (612) 920-7393	Outwater Plastics 4 Passaic St Wood-Ridge NJ 07075 (800) 526-0462	Sign Business 1008 Depot Hill Office Pk Broomfield CO 80020 (303) 469-0424	US Plastics 1390 Neubrecht Rd Lima OH 45801 (800) 537-9724
Cineflex Box 20027 Riverside CA 92516 (909) 781-1917	DTM 1611 Headway Cr B2 Austin TX 78754 (512) 339-2922	IPAC 185 Commerce Center Greenville SC 29615 (800) 820-IPAC	Paper & Foil Converter 29 N Wacker Dr Chicago IL 60606 (312) 726-2802	SignCraft PO Box 06031 Ft Myers FL 33908 (813) 939-4644	West Systems PO Box 908 Bay City MI 48707 (517) 684-7286

forcibly eject themselves from bicycle carriers and dump your mail all over the road; and mailers that instantly destroy electric letter openers.

UHMW is a specialized variant of polyethylene which has an ultra high molecular weight. It is very slippery and has extreme cut resistance. "Self healing" cutting blocks and conveyor rails are two important uses. UHMW impact resistance is unbeatable.

Urethane is that incredibly durable rubber-like plastic. Its durometer can be adjusted all the way from rigid to ultra flexible. It is also an outstanding low temperature casting resin.

Getting Started

One source for engineering plastics in very small quantities is *Small Parts*. They also custom-cut sheets and rods of nylon, delrin, teflon, and a few of the other engineering plastics.

Real bargains in plastic items can often be found at *American Science & Surplus*. Since these are left over from some other use, it's strictly catch as catch can. And WYGIWYG — what you get is what you get.

One traditional plastics distributor that I've found to be fairly reasonable is *U.S. Plastics*. A competitor is *Ain Plastics*. Free catalogs from both.

The classic old line name brand big distributor is *Cadillac Plastics*.

But the best sources I've found for price and delivery are the outfits who aim at the school markets. Especially those that advertise in *School Shop* and similar magazines.

Let's see. *Iasco* is short for *Industrial Arts Supply Company*. They have now got everything from a liquid plastisol for use in fish lures to

acrylic powder casting to real injection molding and vacuum forming machines. A useful second source is *Delvies Plastics* who also offer lots of books and patterns.

Model and hobby sources are also useful. See the ads in *Model Railroad* and similar mags. One leader here for styrene parts is *Evergreen*. They offer a free *Styrene Handbook*. Subtitled *Tips and Basic Techniques on Working With Styrene Plastic*.

Be sure to get this one.

Injection Molding

It sure is infuriating to go down to your hobby store and look in a cheap kit and see bunches of highly detailed injection molded parts, but have the molders laugh in your face when you want to get anything injection molded on your own.

The problem is that most injection molded parts can be extremely cheap. But only when ordered in humongous quantities. There are major front end charges involved in making the molds and in machine set-up.

Because of the steep front end costs *injection molding is totally unsuitable for most low volume uses*.

Surprisingly, there are several low-cost injection molding machines for do-it-yourself users. The cheapest is that *Quick Shooter* sold by *Haygeman Machine* at \$560.00 list. This one uses a drill press to create the injection force. Shots up to 1/3 ounce are possible at a 100 shot per hour rate.

Higher performance machines are offered by *Morgan Press*. They offer a \$20.00 book called *Cutting Costs in Short Run Plastics Injection Molding*.

Alternates include the *Tri-Tron* 303, the *X-Tron* 300A, an *Alumi-Tron* 66M, and others distributed by *Iasco*. A *Plasticor* PLA-63 is offered by *Delvies*.

My Glue Gun Trick

There's one ultra-cheap alternative to injection molding that I sometimes use. Yeah, this one is crude, slow, and produces rather wimpy products. But the cost is nearly zero. You simply use polyethylene rods in a glue gun!

Squirted into any cavity, you can build up a solid and reasonably useful plastic part. This stunt is particularly handy to build up oddball connectors. Just find some mating pins and plug them into the connector to be fit. Then polyglop them. For extra strength and a better final appearance, you can coat everything with epoxy.

At one time, many larger glue gun suppliers did stock the polyethylene rods. Sadly, these are unlikely to be available at your hardware store. *Ain* has them at 20 cents a foot.

Vacuum Forming

A low-cost and sometimes alternate to injection molding is called *vacuum forming* in which you lay a thin sheet of plastic on a form, heat it, and then suck it down onto the surface. Zillions of tiny holes in the form are routed to a vacuum pump. Vacuum forming is often used for larger size signs.

Again, vacuum forming machines are stocked by both *Iasco* and *Delvies*. Another school-shop oriented supplier is *Pitsco*. They also resell rotational molders and blow molders.

These are not at all that expen-

sive. And it is possible to build your own.

One superb resource for all sorts of books involving do-it-yourself home machinery is *Lindsay Publications*. One of their hundreds of titles is *How to Cast Small Metal and Rubber Parts*.

Rigid Vinyl

What is the cheapest sheet plastic you can get? Often it is a variation on PVC known as *rigid vinyl*. This one is the standard plastic used for interior signs and advertising displays. Prices start at 50 cents per square foot.

Lots of colors and textures.

You can cut this using any simple Plexiglass scoring tool. It heat forms and bends easily. This bonds just fine using superglue or model cements. I have used it for custom dials.

Ain is one source. Others advertise in normal trade resources — *POP* and *Sign Design*, *Signcraft*, and in the *Sign Business* magazines.

Special Effects

One little known resource for many types of highly useful plastics in small quantities is the movie *special effects* industry. All the folks that create the movie magic. While some of this info appears in *Film and Video*, the leading top secret insider pub is *Cineflex*.

Two suppliers here include *Polytek* and *Special Effects Supply*.

A listing of dozens of other special effects resources is in HACK72.PDF.

Santa Claus Machines

Well, that's what the science fiction folks call them. Replication machines that, on software command, can make a copy of anything for you. Roast beef sandwich, a new girlfriend, hundred dollar bill, you name it.

Surprisingly, these devices do exist today. But the roast beef sandwiches, while low in calories and fat free, do leave a distinctly acrylic aftertaste.

These also go by the names of *rapid prototyping machines*. In which plastic or metal parts get built up by several processes such as selective hardening of a photopolymer, sintering of some powder, extruding some sticky string, injection of a binder, or cutting of a gasket-like layer. Three leaders here are *3-D Systems*, *DTM*, and *Stratasys*.

While Santa Claus machines remain rather expensive (a house and two cars), it should be possible to build a crude version yourself for

RESOURCE BIN

\$200.00 or so. Such as adding X-Y movement to a polyethylene loaded glue gun to make house letters or whatever.

More on Santa Claus machines is found in HACK01.PDF, HACK36.PDF, HACK40.PDF, HACK54.PDF, and in HACK77.PDF.

Random Stuff

A fine collection of glues, sealants, bonding agents, and casting plastics gets distributed by Ellsworth.

Two manufacturers include Devcon and Master Bond who also sell epoxy stripping chemicals.

Plastic sheets for printing and new desktop aps appear in Paper, Film, and Foil Converter, or Converting. Catalina Plastics sells printing mylar.

Stevens is one source for electronic and structural fiberglass items.

Decorative holographic, prismatic, and diffraction grating plastics sheets are manufactured by Coburn. Sources for poly shipping bags include Ipac, and Associated Bag.

One leading supplier for epoxy and fiberglass casting resins and such is West Systems. Free tech manuals.

That ordinary deeper red plexi-

glass makes an acceptable infrared filter for IR remotes. But Rohm and Haas has special opaque plexiglass sheets that are optimized for IR uses.

They have an Infrared Transmittance of Opaque Plexiglas Colors ap note. The #2711 "color" costs only a few cents per square inch.

Adhesives and Sealants Industry is a trade journal that really knows how to stick to their subjects.

Lots of photopolymer resources are reviewed in HACK66.PDF.

Silicon rubber and sealants are now made by Dow Corning. They've got a freebie Solutions newsletter. There are lots of plastics industry insider trade mags. Such as Modern Plastics.

The leading source of plastic caps, protectors, and coverings is Caplugs.

Free sample pacs on request.

Plastic cases and enclosures did get reviewed in NUTS15.PDF on my Genie PSRT. This one is also available in my Resource Bin book.

The premium printed circuit plastic is G-10 fiberglass. But more economic FR-4 variants are available. These use fewer glass layers with more plastic. Ultra-cheapo high-volume consumer aps still stick with brittle phenolic.

Kepro is a good supplier for all of these materials in smaller quantities. The higher frequency materials get sold by Rogers. Circuits Manufacturing is a typical trade journal.

Plastic Grecian urns are offered by Outwater Plastics. Who carry scads of other goodies from store fixture clips on up to architectural columns.

Plastic Gargoyles are created by the Design Toscano folks.

Vinyls suitable for cut lettering are available from Gerber. Struhl has static cling vinyls. They all stick to windows without using any glue.

A plastic synthetic kale is available from Garden Fresh Products. For 100% authenticity, they do use real powdered kale as a filler.

I sure sleep better at night knowing that there are those of you out there who have dedicated your lives to the perfection of synthetic kale.

This Month's Contests

For our contest this month, just tell me about any plastics resource I don't already know about. Or tell me about the oddest thing you have ever done with a glue gun. Best of all, find me a new use for synthetic kale.

There will be a largish pile of my

new Incredible Secret Money Machine II books going to the dozen or so better entries, plus an all-expense-paid (FOB Thatcher, AZ) tinaja quest for two that will go to the very best of all.

Send all your written entries to me here at Synergetics, rather than to Nuts & Volts editorial.

Let's hear from you. NV

Microcomputer pioneer and guru Don Lancaster is the author of 33 books and countless tech articles. Don maintains his no-charge US tech helpline found at (520) 428-4073, besides offering all of his own books, reprints, and consulting services. Don also has two free catalogs full of his resource secrets waiting for you. Your best calling times are 8-5 on weekdays, Mountain Standard Time.

Don is now the sysop of GENIE PSRT, where a special Resource Bin topic has been reserved for Nuts & Volts readers. For modem access: (800) 638-8369. When prompted, enter JOINGENIE. When asked for an offer code, enter DMD524.

You can also reach Don at Synergetics, Box 809, Thatcher, AZ 85552. Or send any messages to his US Internet address of SYNERGETICS@GENIE.COM

SATELLITE EQUIPMENT cont.

BUYING GENUINE UNMODIFIED TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. JERROLD DPV and DPBB. PIONEERS, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

33,000 LOCALITIES longitude and latitudes database plus Lotus 123 spreadsheet to find any satellite around the globe \$18.95. EM, PO Box 1165, Rocklin, CA 95677.

SATELLITE SYSTEM complete 10' dish C/KU bands \$600/OBO. Fred 619-434-9701.

WHAT!? YOU don't have the new TELECODE 20 page 1996 CATALOG!? It's free! 520-782-2316.

GET SOUND for VCII and VCII Plus without codes. Free detail. Send SASE to: Nassirian, Box 382-V, Rio Linda, CA 95673.

USED SATELLITE EQUIPMENT. You name it, we have it. LNAs, downconverters, drives, receivers. Working condition guaranteed. Call 317-385-2305.

DBS MODEM PROBLEMS can be corrected with a simple, do-it-yourself device. Will resolve most PPV callback problems. For schematic, send SASE + \$2 to DAD Technologies, 25850 169th St., Spirit Lake, IA 51360.

1.2 MEGABYTES of satellite tracking programs. Lists every satellite visible in US, coordinates, channel frequencies, audio carriers, scrambling methods. Computes solar outages, telemetric data sources for low orbiting satellites. \$8. Cabletronics, Box 30502N, Bethesda, MD 20824.

The RF Connection
213 North Frederick Ave.
Suite 11NV
Gaithersburg, MD USA
20877

Complete Selection of MIL-Spec Coax, RF Connectors and Relays

UG-21B/U N Male for RG-213/214 \$5.00
UG-21D/U N Male for RG-213/214 \$3.25

N Connectors for 9913/Flexi4XL/9096

UG-21B/9913.....\$5.75 Pins Only.....\$1.50
UG-21D/9913.....\$4.00 Extra Gasket......50

Amphenol 83-1SP-1050 PL-259 \$0.90
UG-176/U Reducer RG-59/8X25 or 5/\$1.00
UG-175/U Reducer RG-58/58A25 or 5/\$1.00
J&I Silver Teflon PL-259 MIL-Spec
..... \$1.25 or 10/\$10.00

MIL-Spec Coax Available (Teflon, PVC 11A)
Certified CQ Flexi 4XL811A (Flexible 9913)

New Product: International's 9096-2A Low Loss RG-8 Size, Stranded Center Conductor Same Specs As 9913.70/ft or \$59.00/100ft

Also New: RG-8X Clear w/UV Jacket 98% Cu Intro Price \$14.00/100ft

Call for Specials of the Month

Full Line of Audio Connectors for Icom, Kenwood, and Yaesu

8 Pin Mike Female.....\$2.00
8 Pin Mike Male Panel\$2.50
13 Pin DIN for Kenwood\$2.75
8 Pin DIN for Icom.....\$1.00
8 Pin DIN for Kenwood.....\$1.50

Prices Do Not Include Shipping

Orders 800/783-2666
Info 301/840-5477
FAX 301/869-3680

Quality ELECTRONICS

Yes, we can help with all your cable needs

QUALITY PRICES

QUALITY SERVICE

QUALITY PRODUCTS

1-800-394-3043

9am-5pm M-S • Same Day Shipping

1 FULL YEAR GUARANTEE

CALL TODAY!

NO NV SALES

CABLE TV Descrambler Kits

"NEW & IMPROVED UNIVERSAL KIT"

Universal Kit 1995.....\$79.95

Includes all the original parts plus the improvements and a silk-screened PC Board. New Product.

Enclosure Package.....\$44.95

Includes all the switches, hardware, AC Adaptor, and a black silk-screened box for above Universal kit.

Tri-Mode Kit.....\$59.95

Includes all the parts (with a SAW filter), a silk-screened PC Board, and AC Adaptor. Not included is the enclosure.

SB-3 Kit.....\$44.95

Includes all the parts, a silk-screened PC Board, and AC Adaptor. Not included is the enclosure.

Kill Caller ID "Blocker".....\$69.00

Protect your privacy, automatically.

Notch Filters.....\$39.00

Tunable.

CALL TOLL FREE 1-800-886-8699

Visa, MasterCard, or COD

Add \$7.50 Shipping and Handling.

Northeast Electronics, Inc.

PO Box 3310-N, North Attleboro, MA 02761

Write in 86 on Reader Service Card.

REPAIRS, SOFTWARE, etc. for satellite equipment. No TX sales. Buying 010, 018, 019 VCIIs. K. Perry, PO Box 816, Leander, Texas. Phone: 512-259-4770.

SCPC RECEIVER, Universal SCPC-100. Like new, all papers, original box. \$200, will pay UPS ground continental US. Opal International, Jim 619-562-1460.

Electronic Training Videos



Learn electronics quickly and easily with UCANDO's computer-animated training videos. Students can learn at their own pace and professionals will find the UCANDO videos to be a valuable source of reference material. If these videos aren't the best learning tools you've ever seen, return them within 30 days for a complete refund. These videos are being used by Tech-Schools, CET's, Military Branches, Ham Operators, Industries, and more, across the United States and around the world. Order today and see how UCANDO is ...

"Changing The Way The World Learns Electronics."

VCR Maintenance & Repair ... \$29.95 All others ... \$44.95 each
 * Intro to VCR Repair * Direct Current * Alternating Current * Semiconductors * Power Supplies *
 Amplifiers * Oscillators * Digital 1 * Digital 2 * Digital 3 * Digital 4 * Digital 5 * Digital 6 * AM Radio * FM
 Radio Part 1 * FM Radio Part 2 * TV Part 1 "Intro to TV" * TV Part 2 "The Front End" * TV Part 3 "Audio"
 * Fiber Optics * Laser Technology *

SAVE! Buy any 6 videos for only \$240 ... or ... Save MORE!!! Buy any 12 videos for only \$450



1-800-678-6113

or mail check or money order to:

UCANDO Videos

P.O. Box 928, Greenville, OH 45331

FREE Shipping ... FREE Catalog



WIRELESS VIDEO THAT WORKS!

- 2.4 GHz FM synthesized design with 4 selectable channels
- 300 foot range can be extended with optional helical antennas
- Fully FCC approved under part 15 for license free comm'l use
- Transmits video and stereo audio; outputs video, audio & RF Ch 3
- Operates on 12 volts DC with included power supplies and cables
- Built-in circular polarized patch antennas for broadcast quality
- Great for covert video surveillance, home entertainment, robotics
- Supercircuits low price is only \$199.95 + \$6.50 shipping!
- Hurry, quantities are limited.



Hot!
New! 2.4 GHz Wireless Video!
Under \$200!

SUPERCIRCUITS

1-800-335-9777 ext.6011

One Supercircuits Plaza, Leander, Texas 78641

AMERICAN, CANADIAN 24 HR. SPORTS/NEWS ALSO CHINESE, FILIPINO & SERBIAN TV. Enjoy programming on above services for satellite TV. **Dealers wanted. We sell, repair B-Mac & Oak decoders. TRIANGLE PRODUCT DISTRIBUTORS USA, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390. M-F 9am to 2pm EST.**

WANTED: LARGE SATELLITE ANTENNAS, 7-20 meter, commercial grade only. Also transmitters for uplink, HPAs, exciters, etc. Prefer Scientific Atlanta, Andrews, Vertex, RSI, etc. Will remove. PTL Cable Service, Inc. Phone 407-747-3647, FAX 407-575-4635.



REVERSE ENGINEERS BIBLE. New book (2/1/1996) explains theory and operation behind reverse engineering. Includes IBM software. Covers: Computers, cellphones, descramblers, GALS/PALS, encryption, dongles, patents, and more. Software for file editing and comparison, logic determination, cracking, disassembling, and more. \$46.45 postpaid. **VISA/MC 520-782-2316. FAX: 520-343-2141. TELECODE, PO Box 6426-NV, Yuma, AZ 85366-6426.**

DESCRAMBLERS, SATELLITE receiver systems, components. Below wholesale! Direct for foreign manufacturers. Any quantity. Many offer free sample components. Complete step-by-step guide, addresses, tips, etc. \$12 postpaid. SMI, Box 2800, Dept. NV, Hendersonville, NC 28793.



CELLULAR PROGRAMMERS PACKAGE OFFER! Volumes 1 and 2 Cellular Hackers Bibles, Cellular Programmers Bible, Bagphone Video Bible, and Cloning Cellular Telephones Video. Software to program all Motorola bag, flip, & brick. Plus NEC, Panasonic, Nokia, and more. \$179. Ppd USA. **VISA/MC 530-782-2316. FAX: 520-343-2141. TELECODE, PO Box 6426-NV, Yuma, AZ 85366-6426.**

OBTAINING SOUND for your VCI and VCI Plus is easy! No codes needed. Details 1-800-211-5635.

HEAR NON-COMMERCIAL satellite radio programs right in your area without the use of a dish or any other expensive receiving equipment. Thousands of these programs are operating today across America. Programs may include talk shows, weather, sport events, news feeds, financial reports, music programs, and data ports. This technology is received through a high tech SCST1 card. Find out today what you have been missing! 1-800-944-0630. Credit card orders accepted.

DBS SMARTER CARD. Our Smarter card is the best on the market. Allows you to test video and audio on all channels on your DBS system. Optional EPROM/card programmer available. For the best prices, call Open Skies, 514-484-1603.

SATELLITE IRDs available. Chaparral, Houston Tracker, Panasonic, Uniden and others. \$69.95 and above. 804-599-4408.



CELLULAR HACKERS BIBLE VOLUME 2. Covers: NAM format maps, reverse voice channel hacking, RVC & FOCC message, unit ID code hacking, SID, control channel frequencies, reverse scanning, Mitsubishi M800 modifications, data stream encoding, control channel signalling, qualification codes, central office codes, 40-50 MHz television tuner hack, ESN codes, ESN/MIN scanning hack. PLUS! Software to program Motorola bag, flip, brick (9121, plus Amps-G2, Moto thru 94xx), Nokia, NEC, Radio-Shack, Panasonic, and Mitsubishi phones. WOW! All this and much more. \$79.95 ppd. Specify 1.2/1.44 MB. **CELLULAR PROGRAMMERS BIBLE 400+** programming instructions \$56.45. **BAGPHONE VIDEO BIBLE.** New video shows and tells ALL about Radio-Shack bag phones. Covers: ESN, cloning, resurrecting "dead phones," checksums, security. Covers R-S and Nokia phones \$39.95. **VISA/MC 520-782-2316 or FAX: 520-343-2141. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.**

TRIMPACK GLOBAL POSITIONING SYSTEMS. Desert Storm military surplus, with manuals, \$375 to \$775. **VERY LIMITED SUPPLY.** Original government cost \$4,796. Details, write, **BORDERS, PO Box 668, Glasgow, KY 42142-0668.**

VIDEOCIPHER II, modules, standalone chassis and repairs. Auto update test software. For repairs call 201-728-3217, 10am-6pm EST. S&J Electronics, 1614-0 Union Valley Rd., W. Milford, NJ 07480. Also buying VC IIs and cable converters.

SATELLITE EQUIPMENT: 40 C/KU receiver/positioner with remote, \$179 each. 1 year warranty. 714-548-5521.

HACKERS SECRETS Volume 2. New book covers: CTCSS, SCPC, cordless telephones, radar, secret frequencies, lockpicking, money laundering, and more! \$36.45. **VISA/MC 520-782-2316. TELECODE, Box 6426-NV, Yuma, AZ 85366-6426.**

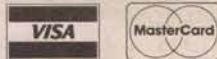
FILIPINO & CHINESE, Oak decoders. Serbian channel coming soon. All on satellite TV broadcast. Oak stand-alone decoder and oak modules. Modules require VCI chassis or IRD to operate. \$249 US. While quantities last. Under development: multi-tier programming on one Oak decoder! For the best prices, call The Oak Specialists, New Advanced Technologies, 514-458-0798.

UNDETECTABLE PHONE TAP

- SOPHISTICATED ULTRA HIGH IMPEDANCE CIRCUITRY AS USED BY CIA AND KGB
- NOT DETECTABLE BY EVEN THE MOST ADVANCED TAP SWEEPING EQUIPMENT
- MONITOR CONVERSATIONS, FAXES AND DATA WITHOUT FEAR OF DETECTION
- PLUG INTO ANY TELEPHONE LINE WITH NO CLICK, HUM, NOISE OR VOLTAGE CHANGE
- UNIVERSAL DESIGN ALLOWS MONITORING WITH HEADPHONES, TELEPHONE OR TAPE RECORDER
- VOICE ACTIVATED TAPE RECORDER CONTROL
- DISGUISED AS "TELEPHONE LINE TESTER"
- COMPACT SIZE - BATTERY POWERED



\$109.95 VISA MC COD



(203) 485-0310

Ar² Communications Products

Box 1242 Burlington CT 06013

Write in 202 on Reader Service Card.

MILITARY SURPLUS ELECTRONICS

WANTED: SURPLUS electronics, tubes, capacitors, test equipment, TV-7D/U, catalogs, amplifiers, record cutting lathes, etc. 612-869-4963.

GOLD! EXTRACTION, recovery, and refining gold from scrap electronics. Book describes in detail the secrets of how to inexpensively remove and refine electroplated gold on a small scale. \$35. Michael Young, PO Box 145, Newville, AL 36353.

MILITARY HEADSETS H-16A 1000Ω \$5.99, 3/\$10. AN/GRC-155A Comm. set, HF 618T-3, ARC-51BX, 807A, RT524. Sunair HF linear amplifiers 1KW. Argus auto ant. tuners. Military veh. comm. acc. 4 ch. 5 speed tape recorders. Electronic Dimensions, 206-272-1061, FAX 206-383-2088.

TRIMPACK GLOBAL POSITIONING SYSTEMS. Desert Storm military surplus, with manuals, \$375 to \$775. **VERY LIMITED SUPPLY.** Original government cost \$4,796. Details, write, BORDERS, PO Box 668, Glasgow, KY 42142-0668.

TEKTRONIX SCOPE 7613 rack mount w/o plug-ins \$175. Fluke 645M frequency synthesizer 0-50MC. Big beauty! \$150. Scope OS106A/USM 117 dual trace + HiGain plug-ins \$195. Tektronix 53/54C plug-in \$75. Wavetek 1002 sweep signal generators (for parts) \$35. GET Engineering NTDS/SCSI interface adapters in bright blue rack mount cabinets \$75. Polarad signal generator 3.8-7.6 GHz, model 1107E-N (P/O Mod 1607E-N) w/modulator 1020ANH \$99. Gould 2800S chart recorder \$99. HP 5245L frequency counters w/5245B \$65. Nevada Metals Co., 310-491-3181 or fax 310-491-3182.

LASER GUIDED missile corner cube 2.5" dia. Perfect condition! Great for very accurate measurements systems, \$70 ea., 2 for \$65 ea., 4 for \$65 ea. S/H \$7. Call Roger @ Optical Design Parts 716-442-5988 or send orders to ODP, PO Box 447, Rochester, NY 14603.

AUDIO/VIDEO/LASER

TEKTRONIX VIDEO: 4692 color graphics printer \$395. 4632 video hard copy \$295. RGB mixer \$95. 690SR 18" color monitor \$195. Trade for test equipment. 802-860-1180.

RUBY & SAPPHIRE LASER RODS. All rods 0.125 dia. & are oriented except that they require polishing on both ends. Lengths from 1" to 8" From 1/2" to 3" @ \$0.35/inch, over 3" @ \$0.48/inch. Please add \$4.95 S/H/Ins. Min. Order \$5. ARGOS SCIENTIFIC, 27475 Ynez Rd. #197, Temecula, CA 92591-4632. Tel. 909-694-9751, Fax 909-676-5351.

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

FIBER OPTIC TRANSMITTER/RECEIVER SALE. Enables you to transmit composite video images from any video source (cameras, VCRs, etc.) over fiber optic cable instead of coax. Complete package includes transmitter, receiver, and two AC adapters. Brand new in the box. Only \$49 or two for \$79 while supplies last. Credit cards okay. Write or fax 501-223-9406 to order. **Software City**, Box 23016, Little Rock, AR 72221.

VCR BELT KITS! Save big bucks by changing broken or worn belts. Send make, model & \$15 to Minute Man Electronics, 37111 Post St. #1, Fremont, CA 94536. Visa or MC. 510-791-5036.

BUYING GENUINE UNMODIFIED TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. **JERROLD** DPV and DPBB. **PIONEERS**, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

SONY RM501 rack slide kits for 5800/5850 VTRS, good condition, \$100 ea./OBO. Call Al eves, 712-362-4119 or leave message.

WANTED: S-VHS stereo video camera. Fred 619-434-9701.

YOSAN 200 channel walkie-talkie! 26.076MHz 28.305 AM 5 watts flexible antenna, 8AA power, accepts spk/mic, \$159 ppd. Catalog \$3. Maxtech, Box 8086, New York, NY 10150.

UNIVERSAL CABLE BOXES WITH PROGRAMMABLE DESCRAMBLER

1. Replacement for all systems.
2. No makes and model required.
3. Built-in copy guard, sleep timer.
4. Volume and remote control, P.G.

1-800-807-6543
\$225 LIMITED TIME ONLY

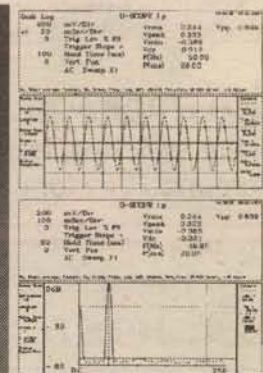
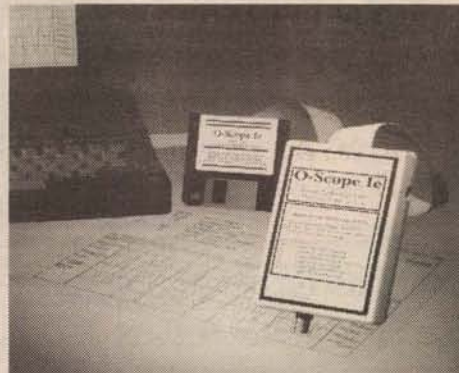
Write in 38 on Reader Service Card.

DIGITAL STORAGE OSCILLOSCOPE

WITH SPECTRUM ANALYZER, DVM, FREQ. COUNTER, AND DATA LOGGER

\$189.

ALLISON O-SCOPE MODULES CONVERT PC'S INTO MULTIPURPOSE TEST AND MEASURING INSTRUMENTS



Screen Capture of Sine Wave

Spectrum of Captured Sine Wave

INCLUDES SOFTWARE & INSTRUCTIONS.

ASSEMBLED AND TESTED..... \$169.
ENHANCED SOFTWARE..... \$ 20.
KIT (WITHOUT CASE)..... \$129.
SHIPPING..... \$7.50 (2ND DAY \$11.50)
TO ORDER: SEND CREDIT CARD INFO., M.O., OR CHECK,

OR YOU MAY CALL **1-800-980-9806**

ALLISON TECHNOLOGY CORPORATION

8343 CARVEL, HOUSTON, TX. 77036 U.S.A.
PHONE: 1-713-777-0401 FAX: 1-713-777-4746
BBS: 1-713-777-4753

FEATURES:

- SMALL & PORTABLE
- USES PRINTER PORT
- USES STD. PROBES
- DC TO 50 KHz
- 10 v/div. TO 50 mv/div.
- MADE IN U.S.A.
- SAME DAY SHIPPING

OPTIONS:

- PROBE SETS
- EXTERNAL TRIGGER
- DUAL TRACE
- BATTERY PACK

WANTED: PRO video equipment, VTRs, switchers, cameras, etc. Advanced Media 702-727-0498.

100 WATT 70 volt transformer, new in box. Perfect for multi-speaker sound system. \$20 each. Dave 414-272-0781.

INFRARED IMAGE converter tubes, power supplies, image intensifier tubes (1st, 2nd, 3rd gen.) detector Dewar assemblies (military flir) infrared Blackbody projector with test pattern and optic. Complete operational TAS -4 imager, GVQ_5 Lazer Rangefinder, + more. Bills Electronics, 519-367-2771.

FM MODULATORS & demodulators: For video, audio & data. Individual rack cabinets with power supplies. Brand name equipment. 75 ohm coax cable compatible. For specs and sale prices SASE to EO Techniques, 16 Slusser Ave., New Hartford, NY 13413-2117. Phone 315-733-4852.

World of Savings from
INTERNATIONAL



MICROELECTRONICS
Surplus & Overstock Company of Electronic Components

CALL NOW
For Your
FREE
Catalog

- Large Inventory
- All New Parts
- Reduced Prices

Phone
800-999-0463
Fax
817-473-0525

Write in 47 on Reader Service Card.

HEY!! RICHARD, THANKS FOR SENDING ME TO THE COMPANY YOU BUY YOUR CIRCUIT BOARDS FROM. YEA THEY GAVE ME THE LOWEST PRICE, BUT YOU NEGLECTED TO MENTION THEIR TECH.SUPPORT NEVER ANSWERS THE PHONE! I SURE SAVED MONEY THANKS TO YOU! NOW ALL I HAVE TO DO IS LEARN TO READ THESE INSTRUCTIONS. . . DO YOU KNOW ANYBODY THAT TRANSLATES JAPANESE? OH YOU THINK THAT'S FUNNY?? MAYBE I'LL CALL YOU DICK INSTEAD OF RICHARD!!!

WHAT CAN I SAY DUDE, THEY GAVE ME A GREAT FREE ORDER FOR REFERRING YOU. I GUESS I'M LUCKY. . . I'VE NEVER NEEDED TECH. SUPPORT!!

***HEY FOLKS, CHECK OUT*
OUR NEW PRICES FOR 96.
SE HABLA ESPAÑOL**

CUSTOMER SERVICE

IT COSTS SIX TIMES MORE TO ATTRACT A NEW CUSTOMER THAN IT DOES TO KEEP AN OLD ONE. A TYPICAL DISSATISFIED CUSTOMER WILL TELL 8-10 OTHER PEOPLE ABOUT THEIR PROBLEM. SEVEN OF TEN COMPLAINING CUSTOMERS WILL DO BUSINESS WITH YOU AGAIN IF YOU RESOLVE THE COMPLAINT IN THEIR FAVOR. IF YOU RESOLVE A COMPLAINT ON THE SPOT 95% WILL DO BUSINESS AGAIN. OF THOSE CUSTOMERS WHO QUIT 68% DO SO BECAUSE OF AN ATTITUDE OF INDIFFERENCE BY THE COMPANY OR A SPECIFIC INDIVIDUAL.

IN SUMMARY, ALL THESE FACTS SAY. . . .

**CUSTOMER SATISFACTION
EQUALS SUCCESS!!**

**BUY FIVE MODULES
AND GET ONE FREE**

CABLE CONVERTER DIAGNOSTIC TEST MODULES

ANYONE IMPLYING THEFT OF SERVICE IN ANY WAY SHAPE OR FORM, DO US AND YOURSELF A FAVOR DON'T BOTHER CALLING US. "AND YES WE DO MEAN YOU" THESE PRODUCTS ARE ONLY AVAILABLE TO QUALIFIED BENCH TECHNICIANS, OR CABLE REPAIR FACILITIES, FOR DIAGNOSTIC TESTING PERIOD III NO PA. SALES.

SCIENTIFIC ATLANTA COMPATIBLE*

	1 PC - 10 PC
STAR VI QUICK KIT	19.95 - 14.95
STAR 7 2/R 5/V 1WIRE . . .	
MULTI MODE QUICK KIT	34.95 - 29.95
STAR 7 2/R 5/V 3 WIRE. . .	
MULTI MODE KIT	34.95 - 29.95
GENESIS STANDARD CUBE	129.95 - 99.95
GENESIS "RE-SPAWN" CUBE	159.95 - 129.95



	1 PC - 10 PC
S/A 8600 QUICK BOARD	34.95 - 29.95
S/A 8590 QUICK BOARD	34.95 - 29.95
S/A 8580 QUICK BOARD	34.95 - 29.95
S/A 8570 QUICK BOARD	34.95 - 29.95
S/A 8580 40 PIN PLUS +	34.95 - 29.95
S/A 8570 /90 /8600 40PIN	34.95 - 29.95
S/A 8550 QUICK BOARD	34.95 - 29.95
S/A 8536 AUTO BOARD	34.95 - 29.95
S/A 8535 AUTO BOARD	34.95 - 29.95
S/A GENESIS CUBE	129.95 - 99.95



VISUAL COMMUNICATIONS INC.
800-GO-CABLE FOR ORDERS ONLY
717-620-4363 FOR CATALOG & TECH. SUPPORT
ESTABLISHED 1975

INTRODUCING GENESIS

NEW GENESIS
SCIENTIFIC/ATLANTA CUBE
NEW FEATURES
RE-SPAWN MODE - MORPHING MODE
MULTI-FREQUENCY - BATTERY OP.

GENESIS IS THE NEW STATE OF THE ART DESIGN IN DIAGNOSTIC TRANSMITTERS. ALLOWS FULL DIAGNOSTIC TEST MODE OF RAW CONVERTERS. IN STOCK FOR MOST BRAND NAME CONVERTERS!!
NOTICE: WE DO NOT SERVICE OR SELL

**CONVERTERS,DESCRAMBLERS
OR ANY DECODING DEVICES!!!**

NOTE: THE ABOVE MENTIONED NAMES ARE ALL REGISTERED TRADEMARKS. ALL REFERENCES TO THE ABOVE MENTIONED EQUIPMENT IS FOR IDENTIFICATION PURPOSES ONLY. WE ARE IN NO WAY IMPLYING THAT ANY OF THE PRODUCTS IN THIS AD ARE ORIGINAL EQUIPMENT. VISUAL COMMUNICATIONS IS IN NO WAY AFFILIATED WITH THE ABOVE MENTIONED COMPANIES OR CORPORATIONS!!

**WE STOCK
A COMPLETE
LINE OF
SECURITY SCREW TOOLS
FOR ALL BRAND NAME CONVERTERS**



BROADCAST VIDEO equipment wanted: all types, new or old. Please call, Jon with info. 317-539-2859.

FREE! THE ETC. Catalog of manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

BEAM SPLITTERS. New, precision, prism-type cube splitters, 29 x 34 mm, ring mounted, highest quality, 3 for \$50. Wade 309-523-3262.

LASER RANGEFINDER measures distances up to 1000 meters: 1 yard/meter accuracy. Built into binoculars, 9V battery operated w/LCD display: \$300. Laser Sensor Technology, 3873 Easy circle, Marietta, GA 30066-2031. 770-928-2867 fax & phone.

PICTUTEL VIDEO teleconferencing systems model 4000ex. 619-632-9775.

SONY BETAMAX VCRs industrial & consumer SLO series \$20-\$100, some working xint & some as-is. Ask Jim, 310-815-9090.

HIGH POWER laser diode modules. 20MW, 640NM, 20MW, 650NM, plus many more. Small brass package contains SMD driver and adjustable lens. Call/FAX for pricing. OEM orders welcome. NVG, Inc., 912-379-0608/FAX 912-375-9555.

VIDEO CAMERAS w/camera control units. IKEGAMI ITC240S, LEITZ adapter, \$295. ITC 240 CCU, MRC-24 remote control \$95 each. HAMAMATSU C-1800 w/CCU & autogain \$495. HITACHI HR34AU super-mini w/CCU \$195. 802-860-1180.

PA SYSTEM. Radio Shack model MPA-20; 120VAC or 12VDC, 20 watt output, \$30. Matching ATLAS AP-30 paging speakers \$25 each. Detection Dynamics, 512-926-8811, FAX 512-926-0940.

LASER GUIDED missile corner cube 2.5" dia. Perfect condition! Great for very accurate measurements systems, \$70 ea., 2 for \$65 ea., 4 for \$65 ea. S/H \$7. Call Roger @ Optical Design Parts 716-442-5988 or send orders to ODP, PO Box 447, Rochester, NY 14603.

FACTORY VIDEOS: VHS or Beta movies need splice or fix \$1 each or \$75/100 pcs. Quantity available. Films: 8mm \$5, 16mm \$10, 35mm \$50. Ask Jim 310-815-9090.

LASER SYSTEM, American 60X argon head rated 80MW at TEMoo, Omnicrome power supply, and beam scan controller. Total value of over \$4,000 selling for \$2,500 OBO. Call Brad at 407-852-4847.

4 EA. RCA CED video disc players with over 250 video titles. \$500 for all. 619-434-9701.

GRAFTEL COLOR VIDEO PROCESSORS, "grab" frames, magnify, edit, store, etc. VP-240 \$295, VP200-6 \$195. 802-860-1180.

U-MATIC VCRs. SONY VO-2600 \$295. NEC VC-9307 \$195. 802-860-1180.

VIDEO TRANSMITS on broadcast TV, tune to receive from channel 14 thru 19. 100 foot range, cable included. \$40 + S&H. Aljon Technologies, 310-793-1788.

CABLE TV

70-CHANNEL plain converter, \$35; Regal CR-83, \$39. We also carry most hand remote as low as \$4.25. Call for free catalog price base on 20 pieces. 405-631-5153, Fax 405-631-4788.

TEST KIT BLOW OUT AND CLEARANCE SALE. All types of compatible test kits at low, low prices. Z-TAC converters and parts. Remote Controls as low as \$1 each. Call 407-676-2530. NO FLORIDA SALES.

POWER SUPPLIES. Wall adapters for sale with mini plugs. Voltage good for SA-3. TVT-3, TBI. If you change polarity on mini plug, you can use them on FTB-3 and SB-3. 100% guaranteed, 100 pieces \$1.75. Call for pricing on smaller or larger quantities. 718-262-0900, FAX 718-657-4015.

ZENITH ST1622 compatible converter, new remote control hand piece, 60-day warranty, reconditioned (even these look new)! \$225. Have some new units \$250. Includes shipping! Guaranteed working. 719-661-1659.

The 18"-DISH DIGITAL SATELLITE TV REVOLUTION! DirecTV, PrimeStar, EchoStar and others

MINIATURE SATELLITE DISHS

The New Digital Television
2nd Edition



by Dr. Frank Baylis

128 pages, 6" x 9"

LEARN the FACTS

- How Ku-band DBS satellite TV works
- The players and their future plans
- What encryption methods are used
- Relation to large-dish C-band systems
- Installing and hooking up

TO ORDER - Send \$20 plus \$4s/h to
Baylin Publications
1905 Mariposa, Boulder, CO 80302

CREDIT CARD orders accepted
Telephone: 303-449-4551 FAX: 303-939-8720

CALL 800-483-2423

Request our FREE CATALOG of books, videos and software on Satellite Television, MMDS & SMATV



CALL for WHAT we HAVE... BUY for WHAT we KNOW!

Don't get "BURNED" Super Bright, 635nm LASERS
COMMERCIAL QUALITY at "HOME MADE" PRICES.

The Choice is Yours?

We offer 24K GOLD for less than their PC board! Our lab models are priced even lower. 24K Gold plated, laser pen, operates from 2 AAA cells. Lab style has internal X/Y adjustment screws. The wide input voltage laser module as internal SMT pwr supply! All provide 800 Yard range and 1.5mrad divergence. Performance you can afford One year warranty!

PEN/\$125, LAB STYLE/\$139, LDM/\$89

Easy to use, WIDE Input 5mW, LASER with 3V to 6VDC power!



670nm, \$39⁰⁰
650nm, \$49⁰⁰
635nm, \$89⁰⁰

SPECIFICATIONS:
DC Power, 3 - 6Vdc, @65mA
Power out, 5mw max.
Range, 100-800 Meters
Glass Collimator (fixed @ inf.)
Size, 0.41" diam. x 0.7" L

Absolutely the best value and best quality available on our commercially made, 670nm, 650nm and 635nm subminiature, laser diode modules. A glass collimating lens provides adjustment free <1.5mrad performance. (comparable to HeNe lasers.) NEW wide input range, internal surface mount power supply operates from 3 to 6 Volts DC. The package is machined brass for excellent thermal characteristics. These are THE quality laser modules.



ESCAP SWISS GEARMOTOR

Superior quality brand new motors. Both the motor and 64:1 gearbox are ball bearing. Able to deliver over 14oz/in of torque @ 112RPM, 6VDC @100mA! Can be operated from 1.5VDC to 12VDC. Stainless steel case. Size: 58mm x 23.8mm diam. With 3mm diam. shaft. Perfect as a drive motor for our linear slides or for robotics. theirs \$200ea. ours \$15.95ea. 3/\$45

THERMAL IMAGING SYSTEM, INFRA METRICS model 525.

Compact and portable. Features: line scan and isotherm modes, seven temp. difference ranges, 10, 20, 50, 100, 200, 500, 1300 °C. Electronic 4x zoom, selectable white or black "hot". Displays grey scale image on any Video monitor. LN₂ cooled via it's internal 30ml dewar. AC power supply. Thermal calibration source and 9" monitor included. Can be operated from 12VDC. Operating range -20 to +1300 °C



- Sensor: HgCdTd
- 250 elements per line.
- FOV 14 x 18,
- Spectral range: 8-12um,
- Head size: 6"x4"x5",
- Processor size: 8"x8"x5" with operating manual and transit case.

originally \$30K
NOW \$3995

NEW! SCIENTIFIC 1/2" COLOR CCD CAMERA with YC/SVHS out Achieves Superior Picture Quality.

380K Pixels, 460 Lines Resolution, 1.5 Lux Sensitivity

All operating parameters are adjustable from outside the camera! Perfect for microscopy and inspection as well as image capture and surveillance. The GM-470C camera, features internal or external sync. Interlaced or Non-Interlaced operation. Adjustable shutter speeds of 1/60 to 1/10000 Sec. Auto White balance selector with three steps. Auto iris output. C or CS mount lens mount. Manual or auto gain as well as external variable gain. Video out on BNC, 12VDC @ 250mA input through standard barrel jack. Truly this camera has it all. Aluminum housing. Size: 50.5mm W x 50.5mm H x 145mm L. New, boxed. w/o lens...\$529ea. w/16mm, f1.6...\$569ea. w/8mm, f1.3...\$589ea.

Truly this camera has it all. Aluminum housing. Size: 50.5mm W x 50.5mm H x 145mm L.

STARRETT, DEPTH GAGE Model 445BZ-3RL, 0-3"

Beautiful, super quality set with three rods, adjustment tool and foam lined case. Limited quantity. Reg. \$125 OUR PRICE \$69

Reg. \$125 OUR PRICE \$69

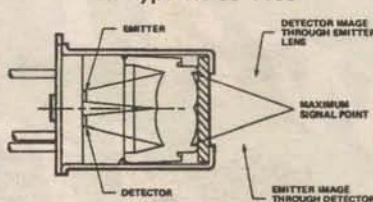
XENON STROBE FLASH,



NEW from Polaroid. High quality & powerful! Oversize flash tube produces 20 JOULES Powered with 4AA batteries. Trigger: with DC signal or switch closure. Self contained with internal battery compartment. BRAND NEW.

3 for \$10 or 10 for \$29.95

HIGH RESOLUTION, OPTICAL REFLECTIVE SENSOR IC, HP type HBSC-1100



The HBSC-1100 is an integrated device for reflective optical sensing. The modified, 8 pin, TO-5 pkg. contains a .007" diam., 700nm visible LED emitter and a matched IC photodetector. A bifurcated aspheric lens images the active areas to a single spot 4.27mm in front of the package. Applications include: pattern recognition and verification, object sizing, textile thread counting, defect detection, line locating, edge detection and bar code scanning. HP price \$27ea.

LIMITED QTY.....\$8.95ea.

SEE in TOTAL DARKNESS!



IR FLOODLIGHT! with 168 LED's !!

Powerful, not power hungry. Projects up to 40 meters. 24V wall adapter, included. Size only 4.5"Wx6.6"Hx1.5"D w/o camera Commercially made and BRAND NEW!

IR FLOOD.....\$159ea.

with INTERNAL PINHOLE CAM.....\$369ea.

NEW BNC "T" adapter, male to dual female.

12V @5AH GATES, new



Deluxe model with insulated outer shroud. (Standard BNC 'T' only insulated!)
with 15' Leads. 3 for \$5 or 10 for \$12
3.5"Wx3"Hx5.5"L \$12.50ea. 3 for \$35

12V@8AH GATES GEL CELL PACK, NEW! Arranged as a 1X6 cell pack.

Pack size: 2"Wx4"Hx11"L
\$10.00ea. Metal box of four, \$29
Coil volts: 120VAC, AC contact rating: up to 35Amps @480V or Tungsten 35A @120 V, NEW, BOXED with data. \$6ea or 2/\$10

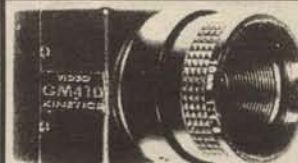
NEW! MERCURY DISPLACEMENT RELAY Dayton 6X598
Hermetic, class "B"
Coil volts: 120VAC, AC contact rating: up to 35Amps @480V or Tungsten 35A @120 V, NEW, BOXED with data. \$6ea or 2/\$10

MINI 1/3" CCD CAMERA TRANSMITS VIDEO + AUDIO TO ANY TV.

Camera with Mic, Transmitter, Receiver, Power adapters, cables and illustrated instruction manual. Even an adjustable tilt and swivel camera mount! Everything you need in one simple package. Ready to operate in minutes. Even has RCA style A/V jacks for direct connection to a VCR!
▼ 1/3" CCD, 380 lines, 0.3lux, Black and White
▼ Transmits on 900MHz up to 120 ft.
▼ Clear high resolution picture and quality audio.
▼ Perfect for Childs room or office/warehouse.
▼ IR Sensitive. Can be used in total darkness with our invisible IR FLOOD shown at left.
▼ Size: Camera: 1.25"H x 2.25"W x 5.25"L Receiver 4.25" x 4.25" x 1"H



COMPLETE PACKAGE SPECIAL \$269ea.



SUPER SENSITIVE, C-MOUNT, MINI CCD CAMERA.

GM-410, B&W camera, 38mm SQ. x40mmD, 1/3" CCD, over 270,000 Pixels, 410 Lines Res., Sens. 0.05 LUX., AGC and Electronic Shutter. 12VDC @100mA power. Three lens options fully exploit its superior performance. Composite out. IR SENSITIVE, RCA video connector and jack for DC power. When you need performance not hype, there is no substitute for a good lens! This camera will out-perform any camera in this magazine guaranteed! BRAND NEW!, less lens...\$189ea. w/16mm, f1.6, (15° fov)...\$219ea., w/8mm, f1.3, (30° fov)...\$239ea. w/4mm, f1.4, (56° fov)...\$239ea., w/4mm, f1.4 Auto Iris Lens...\$325ea.

GM600 HIGH RES. B/W 1/2" CCD

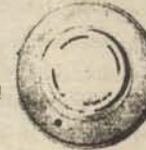
425K pixels, 600 Lines resolution, 0.02LUX sensitivity. Access all operating parameters from outside the camera! 12VDC pwr. Dual threaded mounts on rugged extruded aluminum housing. Sony CCD! This camera provides true scientific quality for half the price! \$449ea. w/o lens



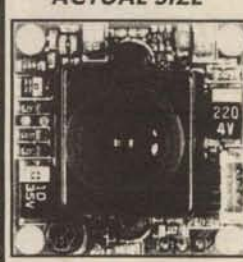
"MOTION DETECTOR" or "SMOKE DETECTOR" CCD CAMERAS,



Now, place video cameras almost anywhere! 0.3 lux. 380 lines, 1/3" CCD, 4mm, f1.8, 78° FOV lens, 9VDC @100mA, auto shutter and AGC, smoked lexan face makes "motion" camera almost invisible! The smoke del. camera uses a pinhole camera!
Motion detector.....\$159ea.
Smoke detector.....\$169ea.



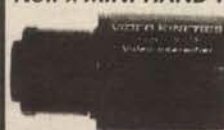
ACTUAL SIZE



CCD MICRO CAMERA, Black and White, 1/3" CCD, with a full 250,000 PIXELS!, 380 Lines Resolution. Sens. 0.3 LUX. AGC and Electronic Shutter. Low Power 9VDC @100mA ALL lenses incl. pinhole, can be focused! FOV, 4mm, 78°, 3mm 110°, Pinhole 91°, 10mm to infinity! A real glass lens! You get what you pay for. A little more, for a lot more quality. Standard video out. 1/2 once! IR SENSITIVE! A brand name camera. Mating Connector w/cable incl.
with 3 or 4mm. Lenses.....\$139ea.
with PINHOLE lens.....\$149ea.
Mini Camera Housing, Black, textured ABS. 1"x1.5"x2".....\$15.95

C-MOUNT, CCD IMAGE INTENSIFIER

Now a MINI HAND HELD VIEWER as WELL Our EXCLUSIVE GM-15K, U.S. made 2nd GEN. I² system provides 15,000X gain. True night vision and super IR capability to any quality CCD camera. Simply install between camera and your C-mount lens! Now you can use your GM-15K as a hand held viewer with our new eyepiece with battery holder. Makes your intensifier twice as useful. Provides you with one of the smallest viewers available! ONLY 2"D x 3.4L Truly fits the palm of your hand.
GM-15K COMPLETE SYSTEM.....\$999



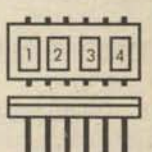
OSCILLOSCOPE PROBES, 100MHz w/READOUT!

If you have a TEK scope with an auto switching attenuator display, you need a probe with the readout option. Don't be fooled by cheap, low priced low bandwidth probes without readout. This one works the way your scope was intended. Complete with all accessories. New...\$39ea. or without readout...\$34ea.



HP ALPHANUMERIC, four character LED DISPLAY,

Type QDSP-2020 Hermetically sealed, Mil spec., Ceramic Package. With integrated serial in parallel out shift registers and constant current row drivers. Standard 0.3", 12 pin dip Configuration.
• End Stackable • TTL compatible
• Wide viewing angle • Extended temp. -40° to +85° C
Character Font is a 5x7 array, 3.8mm high. Operates from 5Vdc, up to 3MHz clock frequency. Typical operating current of 45ma with programmable LED drive. Perfect for I/O terminals, avionics and portable instrumentation. With data. Lid. Qty. 4 packages for 19.95 or 10 packages for \$39.95



RESOURCES UN-LTD.

8030 SOUTH WILLOW ST., BLDG. 2, MANCHESTER, NH 03109

VISA, MC, AMEX, DISCOVER, COD. ORDER LINE: 800-810-4070 TECH LINE: 603-668-2499 ORDER by FAX: 603-644-7825

by
Harry Helms

programs, like screen savers and virus detection software, are among the worst offenders in this regard.

Here's an actual example I recently ran into. I had been using a popular

W

hen I first began writing this column, I managed to stir up a real hornet's nest by declaring that any software developer interested in maximizing their income should focus exclusively on

Windows PC hardware and software and forget about other operating

Software Wizardry

Windows PC hardware and software and forget about other operating
in g systems like the Macintosh, OS/2, etc. Several angry proponents of other operating systems sent letters to *Nuts & Volts* pointing out the advantages these systems have over Windows PCs.

This column is Windows-oriented for a reason that has nothing to do with its technical strengths or weaknesses, namely the sheer number of Windows PCs in use, and the large number of applications and development tools available for Windows. In fact, I always considered Windows 3.1 to be grossly inferior to both the Mac OS and IBM's OS/2 (although I feel Windows 95 is competitive with both, and Windows NT to be clearly superior to either the Macintosh or OS/2).

My advocacy of Windows as the preferred development environment for independent software developers has always been based on the number of Windows users and the ease with which software for Windows PCs could be developed by one-person operations. From a technical standpoint, Windows 3.0/3.1 and — yes! — Windows 95 PCs have some shortcomings and pitfalls for developers and end users of software.

There are two ways to react to this situation. You can adopt a "morally pure" stance, and advocate and develop for non-Windows operating systems that have a market share that's already in the single digits and still declining. The other is to understand the most common causes of Windows problems and how to correct them, and then use that knowledge to your advantage. I know of several people who are making a very good living advising Windows users how to handle the problems we'll discuss in this month's column. If you can't convince people to switch to OS/2 or the Mac, why not at least make some money off them?

TSR Troubles

Windows is notorious for problems caused by conflicts when two or more applications programs "multi-task" (that is, the programs are simultaneously "open" and using the operating system's resources). This reputation is a little unfair to Windows, since the problems are usually caused by applications programmers deviating from Windows development guidelines and "sneaking around" Windows in order to squeeze out a little more performance. Terminate and stay resident (TSR)

virus detection program with my 486 Windows 3.1 system.

When I added a 100 MHz Pentium Windows 95 system to my tools, I installed the virus detection software when I did my system set-up and software installation. I soon became convinced there was some sort of major hardware flaw with my new Pentium system.

The mouse, keyboard, and monitor display would sometimes unexpectedly "freeze," forcing me to completely re-boot the system. My hard drive would sometimes go into extended read cycles when accessing a file, and sometimes a couple of "beeps" would be emitted

Solving Common Problems With Windows PCs

ted from my PC during the process. All of these symptoms were the sort that could be caused by hardware problems, and I spent a good bit of time on the phone to technical support at my PC's manufacturer. It seemed as if there were some weird transients in my PC's hard drive controller and keyboard/mouse interface boards, and that I would have to send my PC in to a repair facility for major surgery.

I postponed sending my new PC in for repair as long as I could since it was my only Pentium and Windows 95 machine, and I wanted to get up to speed on both before being without my new PC for a few weeks. When I ordered my new PC, I had also ordered Windows 95 upgrades of my existing Windows software such as Visual Basic and Word. When those upgrades arrived, I decided to install them even though I knew the PC would soon be going in for repairs. And that's when I solved my problems.

The solution came in the form of a new problem. The guidelines for Windows 95 software call for the installation programs for each new application to scan the PC's hard drive to make sure there is adequate storage space available before proceeding with the installation. When I tried to install my new software, the "hard disk scan" portion of each installation routine caused my PC to totally freeze. Nothing worked — the mouse, the keyboard, the monitor — nothing! And this happened for each and every Windows 95 package I was trying to install!

It was at this point that I had the sort of inspiration

you get when you're really desperate. It occurred to me that some computer viruses scan a PC's hard drive in order to locate system.ini, config.sys, and other important files to trash. Maybe my virus detection software — which was TSR software loaded every time my PC was started — was interpreting the disk scan action of the new software as a virus attack and was "freezing" the PC to protect it from a virus attack. It was a theory worth trying out, so I removed the virus protection software from my PC and tried installing the new software once more.

You can probably guess the end of this story. Removing the virus protection software cured my installation problems with my Windows 95 applications. But there was more.

The mouse, keyboard, and monitor "freezes" stopped, as did the extended hard drive read cycles and sporadic beeps. In fact, the overall operating speed of Windows 95 improved markedly after removing the virus protection — apparently the virus protector was fighting Windows 95 every step of the way! I've since added a virus protection program written expressly for Windows 95, and so far the problems haven't returned. It looks like my new PC won't be making a trip to a service facility after all!

Screen saver programs are another common source of software conflicts. They can be so troublesome in video-intensive applications (like multimedia) that it's a good idea to disable all such screen savers before attempting to use a multimedia CD-ROM or video editing program. Like my experience with the virus protection software, the symptoms of conflicts between screen savers and Windows can strongly mimic the symptoms of hardware problems and send you on some extended wild goose chases.

In fairness to my original virus protection software and Windows 95, the virus protector worked fine under Windows 3.1. A lot of software written for Windows 3.1 deviated significantly from Microsoft's guidelines, and there's no way Windows 95 could handle every weird exception individual programmers may have made to normal practice (especially in such areas as memory allocation). No, the fault for the situation lies with me and my assumption that any Windows 3.1 software that extensively addresses the PC's internals would work fine under Windows 95. But I know I'm not the only one out there making that mistake.

While this column focuses on Windows PCs, both Macintosh and OS/2 PCs can be afflicted by software conflicts. My Macintosh IIsi was once brought to its knees when I tried adding a screen saver featuring the "Energizer Bunny" character. The problem turned out to be with an existing screen saver on my IIsi; even though I had "turned off" the previous screen saver in the Mac's control panel, it still had a conflict with the new one. The problem cleared up only when I removed one of the two screen savers from the IIsi's hard drive. I could have either the Energizer Bunny or flying toasters on my hard drive, but not both!

If you've recently installed any new software — whether a major application like a word processing package or a dinky little printer driver — and start experiencing any abnormal conditions with your PC, a conflict between the new software and the old software on your PC should be your prime suspect. By the way, this doesn't mean the new software is "at fault." The new software could be written in conformance with Windows guidelines, but have a conflict with software already on your PC that's not written to Windows guidelines.

Driven Crazy by Drivers

A driver is a program intended to let a PC "talk to" a piece of hardware such as a printer, video or sound card, disk drive, etc. Drivers are simple programs com-

Software Wizardry

pared to operating systems or large applications like databases, but they are essential "glue" for holding all the pieces of PC hardware together. Most drivers are sold as part of a hardware package, and as a result are often not developed with the same degree of care (or programmer competence!) as operating systems and major applications. Moreover, drivers are often not tested on as wide a range of PC systems as operating systems and major applications. As a result, a disproportionate share of PC problems involve drivers.

For some reason, video card drivers seem to be especially "buggy." It seems like some video card manufacturers are constantly updating the drivers for their cards. Even if you don't have any current problems with your PC or video display, you might want to contact the manufacturer of your video card to see if an updated driver is available. Drivers are also a likely problem source with add-in hard drives and CD-ROM drives.

Many development tools or applications programs will install their own drivers. If you should later remove the tool or program, the driver can remain installed even if you've removed the major program files. If your config.sys, autoexec.bat, or system.ini files were modified to load a driver you no longer need, you may get a series of baffling general protection fault (GPF) messages produced by the unneeded driver. This condition is especially common with some multimedia CD-ROMs that modify a PC's system files as part of their installation routine. I started experiencing random GPF messages after I had used a poorly designed and developed CD-ROM package (hint: it had obviously been developed on a Macintosh using Director and then been "ported over" to Windows). I spent some fruitless hours trying to figure out what was wrong until I finally looked at the list of drivers in Window's control panel. I saw a MPEG driver that had apparently been installed by the CD-ROM I had used (I knew I hadn't installed it!). I first copied the MPEG driver to a floppy, in case I really needed it, and then deleted the driver from the list. I re-booted, and my random GPF messages disappeared.

A very important point to remember is that drivers must be written specifically to accommodate the hardware they work with. Despite what you may have heard (or read), there's no such thing as a "generic" video card or printer driver. If you install the wrong driver for a video card — or don't install the correct new driver when installing a new video card — your display may not work correctly, or even work at all, when you re-boot your PC after installing the new card and/or driver. Always save a copy of any driver you delete from your PC, in case the new or replacement driver does not work. And don't install a driver that you "think" will work; if you're not

certain that it's the correct driver, don't install it!

More Memory!

My golden rule is that you can never have too much RAM in your PC, regardless of whether you're running Windows, OS/2, or the Macintosh OS. In fact, I don't think there is an easier or more cost-effective way to improve the performance of your PC and prevent many random software glitches than to add more RAM to your PC.

This is especially true because the minimum RAM requirements for many popular software packages is grossly understated. For acceptable performance with most software, I normally double the minimum amount of RAM that is supposedly necessary. For example, if the software is supposed to require four megabytes of RAM to run, I assume it will require eight megs to run really well!

The improvement in PC from adding additional RAM is often dramatic. My company has several different PCs available for software testing, and these range from 386DX to 133 MHz Pentium systems. One remarkable thing we've discovered is how a 386 PC with 16 megs of RAM will generally outperform a comparable 486 PC equipped with eight megs of RAM. Files open faster, video and sound playback is better, and computation-intensive operations (like graphics) are quicker on the lower-end microprocessor (the 386) addressing additional memory. One real surprise is how Windows 95 runs better on a 386 PC with 16 megs of RAM of than it does on a 486 PC with eight megs of RAM!

Your minimum RAM requirement goes up with the power of your processor. While eight megs of RAM is plenty for 386 PCs and most 486 PCs, it is too low for the most effective use of a Pentium or PowerPC system. I know most PowerPC and Pentium PCs are sold with only eight megs of RAM installed, but that's like selling a Ferrari with an eight gallon fuel tank. The incredible performance of the Ferrari would be interrupted by frequent fuel stops, and that would grow old in a hurry. In a PC, "fuel stops" involve reading and writing to your hard drive, which cuts down on the speed with which files can be opened, video displayed, etc. A lot of the extra computing power in your processor will sit idle while data is loaded into and out of RAM. Extra RAM means your PowerPC or Pentium stays busy computing.

Settings

Both Windows and Macintosh PCs have "control

panels" or "settings" controls to allow changing screen colors, display resolution, and other system characteristics. It's easy to mis-set a setting or not realize the default setting is not the one you need.

For example, the standard installation of Windows 3.1 sets the video display to 16-color mode. However, most Windows software (and all multimedia CD-ROMs and graphics software) is designed to work with a 256-color display. When the display is set to 16-color mode, the result is a grainy, "washed out" image. A lot of "something's wrong with the video on your CD-ROM" calls that CD-ROM publishers get are the result of users having their video displays set to 16-color mode!

Screen resolution settings are another trouble spot. The "small" screen display setting is 640x480 (VGA), which is the default setting for most consumer PCs. Most PCs are also capable of 800x600 (SVGA) resolution, and 1024x768 (UltraVGA/8514A) resolution is becoming increasingly common. However, an increasing number of software packages (especially editing, graphics, and development tools) are designed to use a SVGA display. If a user tries to use a program like Visual Basic or PageMaker on a VGA resolution display, toolbars, controls, and panels used by the application will be "off screen." Users can scroll horizontally and vertically to reach those elements, but most users will want all such elements to be visible. Believe it or not, having the wrong screen resolution setting is a common source for calls to PC and software company technical support lines!

Another problem that can be encountered with SVGA and UltraVGA/8514A resolution is when the "large" screen fonts setting is selected. With some applications and CD-ROM titles (but not all!), screen fonts will appear distorted with the "large" setting. Changing the setting to "normal" or "small" will cure the problem.

Finally, many default buffer settings for such things as cache memory will be set to their minimums. With higher end PCs, this can seriously impair operation. For example, some PCs have trouble with audio "breakup" and interruption when playing sound (.wav) files from either CD-ROMs or hard drives. Increasing the buffer size of your sound card driver to eight seconds will often cure this problem.

Of course, a lot more can go wrong with Windows PCs than we've covered this month. However, it is surprising how often these problems are found and how they can confound non-technical PC users. Knowing these techniques can quickly turn you into your office's (or school's) PC-wizard-in-residence! NV

DESCRAMBLER

BUY DIRECT FROM THE MANUFACTURE, COME!!!

PARTNERSHIP WITH US. WE TAKE CARE OF OUR DISTRIBUTORS WE WILL SELL YOU 1 THRU 100 OF THE FINEST INTEGRATED SYSTEMS ON THE MARKET. WE GUARANTEE TO BEAT ANYONE'S PRICES ON SAME QUALITY ONE PIECE SYSTEM. ALL IN ONE SPECIAL: CONVERTERS/DESCRAMBLERS ONE PIECE SYSTEMS. NO MORE MESSY WIRES OR POWER SUPPLIES REQUIRED VIBER II REPLACE ALL TNT, TVT, STEALTH \$145.00

VIBER VM8 REPLACE SCIENTIFIC ATLANTA 8600 AND LOWER \$169.00

VIBER 80 REPLACE SCIENTIFIC ATLANTA 8590, 70, 55, & LOWER \$145.00

PANS PM ELECTRONICS

TVT-3G\$32

STEALTH\$39

PIONEER\$55

(909) 688-1768



Miniature Transmitters and Receivers

Small, Attractive, High End Quality, 2 Channel Transmitter

59,049 Settable Codes, 150'-300' Range, 1-1/4"x2"x7/16", Assembled



	Qty	1	5	10
RF300T 150' Transmitter		24.95	19.95	15.95
RF300XT 300' Range Transmitter		29.95	24.95	19.95

Small, High End Quality, Receiver for the RF300 Transmitters

1-1/4"x3-3/4"x9/16", 8-24 vdc CMOS Input / Outputs, PCB



RF300R Receiver, assembled	24.95	20.95	16.95
RF300RK Receiver, Parts Kit	19.95	15.95	12.95



Small, Economical, Transmitter and Receiver Set

Set Code, 60' Range, 1-7/8"x2-3/8"x7/16" (T), 2"x2-3/4"x9/16" (R)

RF60 Transmitter and Receiver	24.95	19.95	14.95
-------------------------------	-------	-------	-------

Add \$4 shipping for first item + \$1 for each additional item. Ca. residents add 8.25% tax
Visa, Mastercard, Money Orders, Personal Checks and Cash C.O.D.s

Visitect Inc. (510) 651-1425 Fax (510) 651-8454
P.O. Box 14156 Fremont, CA. 94539

OAK SIGMA

Full Access Test Modules!

FINALLY! Full Access Test modules that work in the Oak Sigma 3D and TV/COM Sigma One (Three Button) cable TV converters. Check out these features.....



- All areas
- All channels
- All functions (Parental Lock, etc.)
- Easy installation/removal *
- Does not 'Time-Out'
- **PROJECTILE IMPERVIOUS!**
- Does not change box ID **

* Requires a one time desoldering of a 40 pin DIP chip, and soldering of a 40 pin DIP socket per box.

** Box can be returned to previous mode in under two minutes!

30-Day Money Back Guarantee
Some restrictions apply

ONLY \$225

Qty 1

All prices include UPS Ground shipping and C.O.D. tag. Quantity Discounts available, please call.

Sorry, but we currently do not sell Sigma converters.

XTREME ELECTRONICS

908-969-2088
908-541-6348
xtreme@paranoia.com

24Hr Info Line
Fax
E-Mail

COD ONLY

Write in 162 on Reader Service Card.

MAJOR PUBLIC AUCTION!

by order of

LORAL

Defense Systems-Eagan

Complete Liquidation of a 300,000 Sq. Ft. Manufacturing Site

Of Special Interest

- Teradyne A360Z analog LSI test system w/4 V/I, KA370 expansion cabinet, M602, M606, M625, M643, M645 & M661
- Sentry 15 (3 each) digital IC tester - liquid cooled, dual 128 pin test heads (64 pins/head) w/manipulators, PMV & 4 DPS (under Schlumberger maintenance contract)
- Xicom 5588 memory test system - single head PPC-25, 10XY address & 12 comparators
- Sentry 50

Handlers

- Symtek 300 (5 each), Symtek 429 (2 each) & Symtek 7936

Auto Insertion

- Universal 6796 & 6772 single head DIP inserters

Environmental Test/Burn-In

- Thermotron temperature & humidity chambers (10 each)
- Despatch & EG&G Wakefield Systems

Environmental Test/Burn-In

- OGP, Inc. - Contour projector mod. OQ-20
- Dozens of microscopes from Wild, Zeiss, Olympus, Bausch & Lomb
- Unholtz-Dickie electro-dynamic shaker/vibrator (3 each)
- SFT 7000 & 7100 XRF coating thickness gauge
- Also available: scanning electron microscope

Test & Measurement

- Test equipment from HP & TEK

Machine Tools

- Surface grinders, lathes, drill presses, mills

Material Handling

- Over 1 mile of power conveyor systems
- Rows of pallet shelving

General Manufacturing

- Dozens of Stanley Vidmar cabinets
- Dozens of fire proof cabinets

Bond #B2488496

Call now for your free detailed brochure **1-800-774-2434**

Thursday, March 28, 1996 at 10am

1 William White Boulevard • Pueblo, Colorado

Preview: Wednesday, March 27 (9am - 5pm)

KOLL DOVE

GLOBAL DISPOSITION SERVICES

A 10% Buyer's Premium Will Apply At This Sale
1241 East Hillside Boulevard • Foster City, California
415-571-7400

EZ-EP DEVICE PROGRAMMER - \$169.95



INEXPENSIVE - Best programmer under \$200.

PORTABLE - Attaches to PC parallel port.

FAST - Programs 27C010 in 23 seconds.

VERSATILE - Supports devices 2716 thru 27080 plus EE and Flash to 32 pins. Reads and writes binary, ASCII hex, Intel Hex, and Motorola S formats.

SERVICE - Information and software updates via BBS or voice. 30 day money back guarantee.

ADAPTERS for additional devices are available.

EP-51 (8751,C51)	\$39.95	EP-PIC (16C5x,61,71,84)	\$49.95
EP-51-PLCC	\$59.95	EP-750 (87C750,751,752)	\$59.95
EP-SOIC28/32	\$49.95	EP-SEE (24xx,93xx Serial EE)	\$34.95
EP-11 (68HC11)	\$59.95	EP-16 (16bit EPROMs)	\$49.95
EP-55 (8755)	\$39.95	EP-49 (8742,48,49)	\$49.95
EP-PLCC32	\$49.95	EP-PEEL (18v8,20g10,22v10)	\$59.95

M2L ELECTRONICS

3526 Jasmine; Suite #4
Los Angeles, CA 90034

310/837-7818

Mon-Fri 9-5
BBS/FAX: 310/841-6050

URL - <http://www.cs.ucla.edu/csd-grads-gs3/loving/www/m2l.html>
CA - add 8.25% tax. UPS Ground - \$5. 2 Day - \$10. Overnight - \$17. COD \$4.75

Write in 123 on Reader Service Card.

CABLE TV cont.

PIONEER BOXES, 6310s Scientific Atlanta 8580s + others. In full test mode. Low prices. Quantity discounts. Houston, TX. 713-691-4610.

SA3B SERVICE MANUAL, schematics, waveforms, troubleshooting, voltage readings, bound booklet, \$10; SA "drop field" secrets and modifications \$15, only money orders. Ponderosa, 3624 Citadel Drive North #330, Colorado Springs, CO 80909.

FREE PAY TV, NEED MONEY? Learn how to make money descrambling pay TV like the pros. You can make up to \$20,000 a month. Anyone can do it almost anywhere in the U.S. No electronics background needed. Order the **NEW BOOK**, Pay TV-The Inside Scoop. Send \$9.95 to A/V Publishers, 16281 S.F. Mission Blvd. #407-N, Granada Hills, CA 91344.

NEW! "PROGRAMMABLE" PIONEER TEST MODE ACTIVATOR ALLOWS USER TO PROGRAM ANY SERIAL NUMBER INSTANTLY! THIS PRODUCT IS SOLD FOR TEST PURPOSES ONLY. \$199, PLUS SHIPPING AND COD. CALL KEN ERNY ELECTRONICS, 24 HR ORDER AND INFORMATION LINE. 516-389-3536.

CABLE DESCRAMBLER! Built with 7 RADIO SHACK parts costing UNDER \$12! Instructions \$8: F.A.S.T., Box 369-VN9, Pt. Salerno, FL 34992-0369.

MASTER COMPONENTS CABLE TV TEST MODULES
EXPERT DESIGNS. 1-800-233-0570
See our DISPLAY AD on Page 13.

WANTED: GENUINE UNMODIFIED JERROLD DCR 4000 music choice with Meistro remote must be turned on with music and simulcast. No calls please if not the above equipment. Phone 609-646-3993.

BUYING GENUINE UNMODIFIED TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. JERROLD DPV and DPBB. PIONEERS, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

Z-TACS For Sale. ST1000 with 288-01. Call 419-385-3100. Ask for John.

PICS, GALS READ if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

SA 8600 boxes while they last \$275. Pioneer 6110 boxes \$200. Also low prices on other equipment. Call for availability. Magic Communications, 805-944-6865. No CA sales.

PIONEER ZENITH ST 1200 and ST 1600 for sale. Quantity pricing available. Call 718-297-9221, 718-297-4877, or FAX 718-657-4015. Ask for Fred.

SCIENTIFIC ATLANTA refurbished 8535-330, 8535-430, 8535-435, 8500-320, 8500-321, all channels turned on, with remote, \$120. Plus \$3 shipping each. Limited quantity. COD only, 412-833-0773.

WE CARRY most CDTV major brands. Call for free catalog. White-Star Electronics, 405-631-5153, Fax 405-631-4788.

CABLE UNSCRAMBLED. Everything you want to know about Cable, but are afraid to ask. \$10. VISA/MC/AMEX. **ELECTROMAN**, Box 24474, New Orleans, LA 70184. 504-482-3017.

CABLE EQUIPMENT FOR ALL YOUR TV NEEDS. ALL BRANDS AVAILABLE. DISCOUNT ON QUANTITIES. WE BEAT EVERYBODY'S PRICES. CALL 713-444-2477. NO TEXAS SALES. VISA, MASTERCARD, DISCOVER.

ER1400 PROGRAMMER schematics, instructions, Scientific Atlanta EPROM master file, operating software. Why buy when you can build for a few dollars? \$20 money order. Ponderosa Company, 3624 Citadel Drive North #330, Colorado Springs, CO 80909.

PIONEER COMPATIBLE TEST KITS. New all-in-one. Multi-mode, mapping and no map all-in-one small kit. \$15 each. Call 407-676-2530. No Florida Sales.

CATV BLOWOUT Sale. Dealers only, 10 lot pricing. MS-80 pan \$45. 86 baseband pan \$55. Boss-Trimode \$125. Boss-Pio \$145. Boss Z-Tac \$190. Boss T \$190. Boss-86 baseband \$190. 8600 orig. \$255. 423-525-2555.

WANTED TO buy: Current models Pioneer 5000 and 6000 series, genuine unmodified Tocom 5503 VIP 5507, SA 8500-321, 8550, 8570, 8580, etc. Genuine unmodified Jerrold DBBB 7312, PR20C, 7322P, DPV 5 212, 210 R3, etc. Call or fax. 718-262-0900, FAX 718-657-4015.

CABLE TV DESCRAMBLERS. THE BEST PRICE IN THE NATION! WE WILL BEAT ANY PRICE! ALL CABLE SYSTEMS AND SOFTWARE. CALL NOW FOR LATEST PRICES. GULF COAST INSTRUMENTS, 1-800-854-8559.

UNBEATABLE SPECIALS multimode 2R/5V kits \$10. Scientific Atlanta 8600, 8580-6 quickboards 2 for \$25. SA 40 pin microprocessors \$15. Pioneer 5xxx to 67xx \$15, (4-wire no switch \$15). Zenith ZL1, T3055, T7055, D5 kits \$4. COD only. \$50 minimum order. We will beat any price. Leave message 1-800-950-5148.

TEST MODULES for all types of CATV converter units. CUSTOM MAPPING for all areas. HRC and STANDARD. Software available. Info diskettes on various converter units. Machine and fax before 7pm EST. Me after 7pm. 717-462-4657.

OAK AUTOMATIC on/off switching assembled boards, for RKDM/KDM-400 equipment, \$25, add \$3 shipping, money order only. Ponderosa, 3624 Citadel Drive North #330, Colorado Springs, CO 80909.

LOOKING FOR brand new 550MHz plain Jane manual fine tuning converter. We have them. We also carry most CDTV products. Call for free catalog 405-634-1535, FAX: 405-634-1580.

DESCRAMBLE CABLE with simple circuit added to Radio Shack RF modulator, part #15-1273, and using cable ready VCR as tuner. Instructions \$10. Parts for all four circuits, \$12.95. S&H \$1. Telcom, Box 832-V2, Brusly, LA 70719.

CBTV CONVERTERS: RX-400-DIC, RZ-DIC: \$59. Pio BA-5XXX: \$150, BA-61XX \$175, 63XX: \$200, Stealth 1000-P: \$49, SA-3, FTB-3 \$49; M-80, Pio-Brown; 63XX, green: \$69. We carry most Pan-cake. Call for low-cost, 60-channel plain converter only: \$29. Tel: 405-634-1535, FAX: 405-634-1587.

CABLE DESCramBLERS, Pioneer 6310s Scientific Atlanta 8580s + others low prices. Discounts for five or more pieces. Quality equipment. 30-day money back guarantee. Call anytime. Houston, TX. 713-691-4610.

MULTIMODE FSK: EXTERNAL TEST DEVICE FOR THE "BIG ONE." FOR USE IN MULTIMODE AREAS. WORKS ON ALL THREE FREQ. NO FILTERS OR ADJUSTMENTS NEEDED, EVER. COMPLETE STEALTH OPERATION. \$150 EACH. QUANTITY DISCOUNTS AVAILABLE. MARC, 1-800-249-4998.

X-MAS SPECIAL, Super stable wireless activator FSK kits \$75, works on all 2R, VPD, and BBVPD boxes. Limited time offer. Sloppy Joe's, 707-778-7488.

PIONEER 6300 cable boxes w/remote and no E-4 modules, map switch, pretested in raw test mode, 1 yr. warranty, special \$195. Pio no E-4 PIC modules 5+ \$16 ea. Pio 6300 master files with serial # conversion Win 95 ver. \$250. PIC 16C54 no E-4 program with serial # \$200. PioWriter \$75. 7 days 7am-9pm PST. 702-892-9183.

CONVERTER SA 8500-311 \$30; 8500-320, 321 \$60; 8530-320 & 321 \$75; 8535 & 8536-330 \$75; 8550-331 & 330 \$75; 8580-338 \$100; 8590 & 8600 \$160; 85 ch. converter \$50; PV5 \$75; PV7 \$120; DRZ-3 \$20 + Panasonic, Zenith ++ all in stock. Tel. 305-220-9384, FAX 305-220-9396.

FILTERS 97.5, 106.5, 108.5, 110.0 70dB deep. \$15 ea. Programmable Pioneer super Q \$85 ea. Super FTG-3 \$75 ea. Dealers wanted. 917-688-9997.

CABLE TELEVISION descramblers. Stop overpaying for your equipment catalog of over 150 companies that sell descramblers and accessories at below wholesale prices. Send \$25 money order or certified check only to: Portnoy's ERA, 350 Northridge Rd., Suite 2B, Atlanta, GA 30350.

ZENITH ST1600 10-lot special. \$175 each with remote. Call for other specials. D&M 1-800-550-8796.

ATTENTION 8511 20 for \$50, Stealth 1000 20 for \$44, P80 20 for \$55. Clearance all Zenith. Must go raw 1014 1600, \$50 MIN 5. All type of test modules available. Buying BB now. Best prices. If you want it, we got it. Call 1-800-973-9278.

MASTER FILES \$25 upward, Pioneer, Sylvania, SA, Zenith, Oak Sigma, and others. Instructions, free catalog, 719-661-1659.

PCB ASSEMBLY. Experienced thru-hole circuit board assembly at low rates. All work fully guaranteed. Let us save you \$. Call 614-354-4791.

CABLE CONVERTERS: 550MHz Panasonic, Regal brand new. Converters feature: IR remote, parental guidance control, favorite channel programming, and more. Special 10-lot pricing. Also available refurbished Pioneer BC4535 converters as low as \$36 while quantities last! Wholesale accounts welcome. Call now, 1-800-757-8186.

DESCRAMBLE CABLE with simple circuit added to Radio Shack RF Modulator part #15-1273 and using cable-ready VCR as tuner instructions, \$10. Telcom, Box 832-V3, Brusly, LA 70719.

CABLE DESCramBLERS. SA 8600 \$245. 5503 \$155. Call 717-788-5939.

WE BUY MEMORY NEW AND USED

SIMMs, SIPP, CREDIT CARD, SOJ, ZIPP, DIP, CPUs, AST • COMPAQ • DELL • HP • IBM • NEC • PACKARD BELL • TI • TOSHIBA • ZENITH & MORE

WE PAY THE HIGHEST AND THE FASTEST!

NO QUANTITY TOO SMALL
OR TOO LARGE

NOW TRADING AND SELLING MEMORY!!!
WE CAN BEAT ANY PRINTED PRICE IN NUTS & VOLTS

PH: 1-800-4-MEMORY
MEMORY MASTERS INC.

Write in 84 on Reader Service Card.

price SET: US\$ 199.00

new! new! new! new!

VIDEO - SENDER

2.4 GHz

VIDEO / AUDIO transmission

power supply not incl.
A/V cable incl.

up to 1/4 mile
open area

techn. data:

RF power output: 10mW
DC power: 11.....16V/DC-0.5A
dimension: 130x80x35mm
AUDIO: in / out
frequency: 2.4 GHz / pll stab.
modulation: A/V FM

DEALER WANTED

PICOTRONIC

Zollamstr.48, 67663 Kaiserslautern GERMANY
FAX++49-631-29579 BBS++ 49-631-21048
phone 0631 29187

TEST MODULES AVAILABLE: Zenith Z3 \$8, SA 8600, 8590, 8580 \$20. Other test modules are also available. Above prices are for quantities of 1-20, other discounts may apply. These items are sold for TEST PURPOSES only and we will not sell to those who imply theft of service. Absolutely NO NORTH CAROLINA SALES. Please CALL or FAX: 910-326-2673.

RFT-1s (10) \$89, (20) \$84. S-Blue/replaces M80 (10) \$59, (20) \$54 10 lot minimum please. Star Electronics. 520-623-9488.

DSE-1000 ENCODER idea for small CDTV refurbish shop \$750 each. Come with instruction hook-up. 30-day warranty: 405-634-1535.

GENUINE UNMODIFIED 2R/V5 converters \$150, no remote. Like new, unmodified GI innovations 450i. Integrated satellite receiver descrambler with RS module, no remote, first \$500. Evenings, 512-854-8989.

CABLE DESCramBLERS, converters test units all at low prices call 717-230-8606 with brand of your current box and model # for a great price 24 hours.

BUYING SCIENTIFIC Atlanta 8600, 8580, 8550, 8500. Software available. SA, Pioneer. Will program your 8550, 8500 EPROMS for \$7.50. Cable security key gets passed collars \$25. Add \$5 shipping. No TX sales. Send postal money order to: K. Perry, PO Box 816, Leander, Texas. Phone: 512-259-4770.

HAMEG®
Instruments

New 30MHz Scopes for low budgets

Made in Germany



Analog Oscilloscope HM303

2 Channel DC-30MHz, sensitivity 1mV - 20V/div.
Timebase 0.2s-10ns/div., triggering 0-100MHz
Component Tester, Probe calibrator 1kHz/1MHz
Overscan indicator, switch. power supply 90-260V

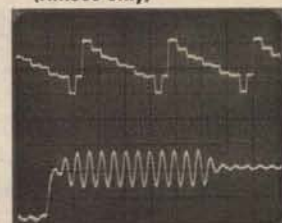
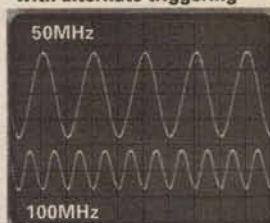


Analog/Digital-Oscilloscope HM305

2 Channel DC-30MHz, sensitivity 1mV - 20V/div.
Timebase 0.2s-10ns/div., triggering 0-100MHz
Component Tester, Probe-Calibrator 1kHz/1MHz
Sampling rate 2x40MS/s, Memory 2x2048x8bit
Refresh, single and roll mode, Pre-Trigger 50%

50 and 100MHz sine wave
with alternate triggering

Stored Video Signals
(HM305 only)



...you should know more about them.

call toll-free at: 800.247.1241

**HAMEG
Inc.**

1939 Plaza Real
Oceanside, CA 92056
(619) 630-4080
(619) 630-6507

266 East Meadow Ave.
East Meadow, NY 11554
(516) 794-4080
(516) 794-1855

Write in 45 on Reader Service Card.

CABLE TV NOTCH FILTERS. Tunable from 50 to 300 MHz (channels 0 thru 36). Eight different models available so specify frequency or channel number when ordering. \$30 each. Large quantity discounts. Call 1-800-433-6319 to receive our brochure or place an order. Star Circuits, PO Box 94917, Las Vegas, NV 89193.

"DESCRAMBLER SCHEMATICS REVEALED." A powerful guide to descrambling schemes. \$10. VISA/MC/AMEX. ELECTROMAN, Box 24474, New Orleans, LA 70184. 504-482-3017.

PIC BUSTERS 16C54 \$2, 16C56 \$2.25, 16C57 \$2.50 ea. Chip burning available. 212-978-3535.

AMAZING

Electronic and Scientific Products

FANTASTIC BRIGHTNESS! ALL NEW Laser Pointers

- High Power
 - Quality Construction • Low Divergence Circular Beam
 - Long Life Standard Batteries • Choose the pointer for your needs:
- LAPN67-N 5mw, Economical, 670nm, 900 ft \$39.50
 LAPN65-N 15mw equiv, Most Popular, 650nm, 1500 ft \$79.50
 LAPN63-N 30mw equiv, Brightest, 630nm, 3000 ft ... Price on Request



Electric Charge Gun

- Stuns Attacker Up to 15' Range
- Legal in Most States
- More Knock Down Power Than Most Handguns
- No Permanent Injury
- Ready to Use with Identifying Code

Special Introductory Offer Includes our 80KV Stun Gun
 ECG10-N \$249.50 Data Pack, creditable toward purchase ... \$10.00



Blitzer Stun Guns

Life is Precious! Protect It!

- Hard Hitting • Reliable
 - READY TO USE
 - STUN80-N, 80,000 Volts \$29.95
 - STUN100-N, 100,000 Volts \$39.95
 - STUN200C-N, 200,000 Volts \$69.95
- Check Local & State Laws Before Ordering



TV Joker

Shirt pocket device allows you to totally control and remotely disrupt TV or radio reception. Great gag to play on family or friends. Discretion required.
 EJK1KM-N Easy to Assemble Kit \$24.50



Long Range 3 Miles! Voice Transmitter

- Super Sensitive Mike
 - Crystal Clear
 - Tunable 80 to 120 MHz • Miniature Design
- XFM1K-N .. \$39.50



FM Telephone 3 Mi Transmitter

- Listen to calls over any FM radio
 - Tunable 70 - 130 MHz
 - Undetectable
 - Only transmits during phone use
- XFT300K-N \$29.50



Wireless Wizard Transmitter

- Rebroadcast VCR, Tape Recorders, Stereo to any TV or FM Radio
 - Eliminates Wires & Cables
 - Wide Band Operation • 70-130 MHz
- RWM3K-N \$24.50



Tracking / Beeper Transmitter

For Homing & Tracking up to 3 Mi
 • Works with any FM radio • 70 - 130 Mhz
 • Use for Hunt Games, Vehicles, Animals, etc. HOD1K-N \$24.50



High Voltage 50,000 VDC Lab Supply

- Sub Mini Design
 - Universal Battery/12VDC/115VAC oper.
 - Many HV applications and experiments
- HV50-N Ready to Use \$149.50



Build a Handheld Ultrasonic Blaster for Self Defense

Phasor Pain Field for Property Protection or High Powered Animal Control System. Many uses. Includes high efficiency transducer. PPP1K-N \$39.95



Laser Window Bounce Listener

Aim at room window and listen to sounds from within using reflected light. Caution - Not for Illegal Use! Includes ready-to-use 5mw laser and long range laser receiver kit. # LWB3K-N \$149.50



Ion Ray Gun

Projects charged ions that induce shocks in people and objects without any connection! Great science project as well as a high tech party prank!
 IOG30N Ready to Use \$99.50
 Higher Powered Lab Version:
 IOG7K-N Kit \$99.50
 IOG70-N Ready to Use \$149.50



ALL NEW! Powerful Home Security Telecom - Infinity Transmitter

Access on premises, ongoing phone calls, phone break-in capability, control of electrical functions such as lights, alarms etc. Caution - Check Legality in Your State!
 TELECOM2K-N Kit, w/PC board \$149.50 TELECOM20-N Ready to Use \$199.50



Voice Changer Telephone

Disguise your voice! Sound like a gruff old man or a sweet young girl. • Variable Disguise Control • 10 number memory • Redial/Hold/Flash • Tone or Pulse • Wall or Desk Mount. # VD10-N \$99.50
 CAUTION: Phone harassment is illegal!



World's Smallest Tesla Coil

Neat little device will light a 40W fluorescent lamp without contact, yet is smaller than a pack of cigarettes. Many interesting applications. 12VDC or 115VAC.
 BTC2-N Kit \$29.95



Jacob's Ladder

Visual display of plasma pyrotechnics. 3" arc travels 30" from top to bottom. Unique solid state 12KV transformer, safety shutdown. Req's wood enclosure and readily available hardware.
 JKC1K-N 12KV Transformer \$74.50



Build a Stun Gun, Flame Thrower...

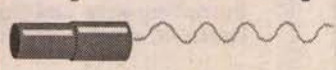
.... Pulsed Shocker, Ignitor, etc. Electronic Module Kit. PSHK1K-N Kit \$29.50

Shocker Force Field/Vehicle Electrifier

Neat device - Make hand and shock balls, shock wands, electrify objects, charge capacitors. Great payback for those wise guys! SHK1K-N EZ Assembly Kit \$24.50

Body Heat Telescope

Detects the presence of living bodies, warm and hot spots, insulation leaks, etc. Use for security, law enforcement, R&D, etc. Dual mode operation.
 BHT1K-N Kit \$99.50



NEON License Frames

Easy to install, high brightness units. Available in purple, green, or pink. Specify color when ordering. While They Last!
 LIC-N (specify color) \$19.50



Extended Play Tel. Taping System

Automatically records both sides of a call. CAUTION: check local laws for alerting beeper requirements. Ready to use with X4 recorder. TAP40X-N \$84.50



Plasma Neon Fire Saber

Active energy field produces the Star Wars effect, visible length of plasma field controlled by grip contact. Choose your color: Photon Blue, Neon Red, Phasor Green or StarFire Purple. FS2K-N \$49.50



Electronic Hypnosis

Puts subjects under control using highly effective electronic stimuli. Intended for entertainment- Must be used with caution. Includes valuable text book reference and plans. EH2-N Plans and Text Book.. \$19.50

1000 Ft++ Spud Cannon

NOT A TOY. Uses electronic or piezo ignition. CAUTION REQUIRED!
 POT1-N Plans (Dangerous Product) \$10.00



See in Total Darkness!

Includes laser IR illuminator kit
 • Light amplification • With camera adapter
 • Hi quality optics • Viewer Ready to Use!
 NVW10-N with Laser Kit \$395.00



Mind Machine

Create Spectacular Hallucinations!
 • New Technology Utilizes Electro-Brainwave Coherence!
 • Uses No Drugs! • Must be over 18
 MIND1-N Plans \$10.00



Plasma Pen

Etch and write ... with the burning fire of electronic plasma! For FUN and PROFIT!
 • Pen Sized - Easy to Use
 • Baggage and Identification
 • Create Spectacular Designs
 PLPEN1K-N \$29.50



Tesla Coil

- 10 to 14" Streamers!
 - Wireless Energy
 - Plasma Pyrotechnics
 - Corona / St Elmo's Fire
 - Lightning
- Toroid Terminal Optional
 BTC3K-N Kit \$299.50



FireBall Gun

Shoots flaming ball! Two shot capacity. Great for special effects and remote fire starting. CAUTION REQUIRED!
 FIREBALL-N Plans (Dangerous Prod.) \$10.00



Mystery Levitating Device!

Remember War of the World? Objects float in air and move to the touch. Defies gravity, amazing gift, conversation piece, magic trick or great science project.
 ANT1K-N Easy to Assemble Kit \$19.50



SUPER VALUE! 3 for 1 HIGH PERFORMANCE Home Surveillance Kits -

You Get ALL 3 for only \$29.95!!!
 Telephone Tape Recorder Switch
 + Long Range 2 mi+ Telephone Transmitter
 + Long Range 2 mi+ Voice Transmitter
 = A GREAT DEAL! Order # COMBO-N ALL 3 UNITS \$29.95



INFORMATION UNLIMITED

Dept NV3, Box 716, Amherst, NH 03031
 Phone: 603-673-4730 FAX 603-672-5406
 MC, VISA, COD, Checks accepted Please add \$5.00 Shipping & Handling

CATALOG!
 With many more items!
 FREE with Order or send \$1 P&H

Order by Mail or by 24 Hour Orders-Only Phone
800-221-1705

OUR 25TH ANNIVERSARY SHOW!

THE GREATER BALTIMORE HAMBOREE AND COMPUTERFEST HOST TO THE ARRL MARYLAND STATE CONVENTION

MARCH 30 & 31, 1996

Timonium Fair Grounds • Timonium, Maryland

**ONE OF THE LARGEST AMATEUR RADIO, COMPUTER,
ELECTRONIC SHOWS IN THE ENTIRE COUNTRY!**

ARRL Forum & Programs • Banquet • FCC Exams • 3 Buildings
10 Acres of Indoor and Outdoor Sales • 1,100 Indoor Spaces
Indoor Fleamarket • Outdoor Tailgate • Acres of Parking
All spaces by advance sale! • Discount weekend passes in advance only!
Write: G.B.H. & C.; P.O. Box 95; Timonium, MD 21094-0095
For 24 hour voice or FAX-Bak information, Call:
In MD dial: 410-HAM-FEST • Outside of MD dial: 1-800-HAM-FEST

CABLE TV cont.

HAMLIN, PIONEER, SA ZENITH and other manufacturer converters, various models including 6600, 6000 and 5000, 8590, 8580, 8529, 8528, 8525 and 8500, 5130, 4130, 4135 and 4535, ST1000 288 and 165 MP, 1086 and 1600, plus other models. Large quantities, CALL for PRICING. 1-800-380-9530.

TVT3 PROBLEMS? Flashing? Intermittent scrambling? Black line? Pulsing white lines? Upgrade with new PLD device \$20. Master file \$25, program your own PLDs. Money order only. Pondersosa, 3624 Citadel Drive North #330, Colorado Springs, CO 80909.

DESCRAMBLING, NEW secret manual. Build your own descramblers for cable and subscription TV. Instructions, schematics for SSAVI, gated sync, sinewave, (HBO, Cinemax, Showtime, UHF, Adult) \$12.95, \$2 postage. Cabletronics, Box 30502N, Bethesda, MD 20824.

CABLE BOXES, major brands, in full test mode. Low prices, quality equip. Dealers welcome. TX, 713-691-4610.

BUYING GENUINE, unmodified Jerrold DPV and DPBB, SA 8550, 8580, 8600 and Zenith 1600s. Quantities 5-500, Fax surplus or request list to 201-728-2615 or call 201-728-3217 10am-6pm EST.

503 \$155 ea. Call, 717-788-5939.

18 VOLT wall adapters for most pans, \$5 single \$4; (10-lot) \$3 (50-lot). Call for 8600 and BB. 405-634-1535.

ZENITH TEST kits (ZL3) 1-5/\$9.95 each, 6-20/\$7.50, 21 and up call. MVR, 1-800-436-8630. No FL Sales.

NOTCH FILTERS positives and negatives available for all channels. \$10 each with quantity discounts to \$5.46 each. QB Video, 1-800-249-3025.

TEST MODULES, DESCRAMBLERS, REMOTES, REMOTES, REMOTES. BEAT LOWEST PRICE. VISA, MC, DISCOVER, AMEX. NO TEXAS SALES. 713-392-2323.

CABLE HACKERS! Program your own! Complete set of master files for Scientific Atlanta, Jerrold, Tocom, Pioneer, Zenith, and Starcom 7! Wow! Blowout Sale. Only \$150! With complete instructions! Send to: Bates, 733 N. Wells, Chicago, IL 60610. 312-213-7023.

WE SPECIALIZE in 5 and 10 lot pricing of NEW converters, descramblers and other cable equipment. One year warranty. No minimum purchase. D&M 1-800-550-8796.

PIONEER CABLE BOX FULL TEST MODE without opening the box! Our external PIO-SC will FULLY activate all channels for TEST mode on ANY Pioneer unit from 5XXX up to 67XX. Does NOT destroy serial/ESN number. Also has 7 other testing options \$175. External PIO-REG does all 5XXX-61XX units or does 1 CUSTOM 63/67XX unit for \$150. 1-800-663-8530.

EXPLOSIVE CABLE TV GRAB! BRINKER ZAPPER/SNOOPER STOPPER combo module all in one! Buy wholesale factory-direct, no middleman. Let others get fined + zapped instead. Protect your cable box now! 100% COMPATIBLE. We supply over 80 advertisers weekly! Your order shipped fast, within hours! Why pay \$39 when you can buy direct! Send \$15 ppd. (2nd only \$10): BRINKER ENGINEERING LABS, Box 348-A, Ellaville, GA 31806-0348.

UNIVERSAL DESCRAMBLER. Unscramble signals using your VCR as the tuner. Works with virtually any system, this is the only one you need. Declare cable box independence! Fully assembled. \$129.95 + \$5 S&H. VISA/MC/AMEX. ELECTROMAN, Box 24474, New Orleans, LA 70184. 504-482-3017.

REMOTES, NEW AND USED. SA beige remotes, checked and working, \$2.50 each. SA Black remotes, \$3 each. Other brands available as low as \$1.50. Below wholesale. Credit cards okay. Write or fax 501-223-9406. Software City, Box 23016, Little Rock, AR 72221.

MASTER PROGRAMMING FILES. Memory devices programmed. Reverse engineering. Circuit boards made and much more. 407-676-2530.

ALL NEW SMART-JR DELUXE! COMES COMPLETE WITH TWO FILTERS EXTERNAL WIRELESS CABLE TESTER/ACTIVATOR PUTS YOUR CABLE BOX IN FULL TEST MODE WITHIN SECONDS. NO WIRING, NO INTERFERENCE, NO HAS-SLE. OUTPERFORMS IN QUALITY, PERFORMANCE AND EASE OF USE. VERY SMALL IN SIZE AND BATTERY OPERATED. JR IS SUITABLE FOR TESTING EXCLUSIVELY ONE MAJOR BRAND OF CABLE BOXES. PRICE FOR A SINGLE UNIT \$145. MAKFIT RESEARCH. 1-800-220-3543. CALLS AFTER 10AM PST. E-MAIL: MAKFIT@DELPHI.COM NO CA SALES.

CABLE DESCRAMBLER! Anyone can build in SEVEN STEPS with RADIO SHACK parts. Plans \$5. 1-800-818-9103.

MMDS, ITFS, OFS antenna and downconverter include AC adapter and mounting accessories. \$150 + S&H. Aljon Technologies, 310-793-1788.

RECEIVE STOCK prices, news, trucking and other info free of monthly fees on TV. Send \$10 and SASE to Electrotec, 2626, W. Parish Ave. #261, Owensboro, KY 42301-3313.

SPRING SPECIAL, multi-frequency, fast, automatic, BFTs for sale. 1-5 \$100, 6-10 \$90, 11-20 \$80. Pioneer programmable tester \$15 extra. Major brand converters in stock. Call 212-926-5284 or 1-800-216-BEEP #48410.

MASTER FILES & TEST MODULES for all types of CATV converter units. TK 503-507, Zenith, SCM-6 only \$6. 909-986-0971.

UNMODIFIED CABLE box pulls Zenith ST 1000, 1086. Regal CR-83 plain converter. Oak RKDM-400 \$20. Other brands available. Call 405-631-1856.

CABLE TV DESCRAMBLERS

Best Wholesale Prices in the U.S.A.!

**DEALERS
WANTED!**

**18 MONTH
WARRANTY!**

	20-49	50+
FX TB	59	50
Stealth	59	50

For Scientific Atlanta Systems

M80	65	55
-----	----	----

For Pioneer Systems

PIO Plus	79	69
----------	----	----

Everquest Converters

Stargate Elite NON-Parental	59	57
-----------------------------	----	----

Stargate Elite Parental	69	59
-------------------------	----	----

**If you want to team up with the leader in
the industry-Give us a call.**

"Our business is to keep you in business."

**CALL
TODAY!!**

**Fast Shipping
Best Service**

**2-DAY
DELIVERY!**

1-800-818-9688

MD Electronics

875 S. 72nd St. • Omaha, NE 68114

Write in 122 on Reader Service Card.

The Key to Added Profits are Printer Trays

For All Popular HP & Canon® Printers



- SX Envelope\$19
- SX Legal, Letter, A-4...\$39
- LX Lower Cassette
(HP, HP, etc.)\$99
- 3si/4si Legal\$69
- HP 4 Legal\$49

Add-On America Corporation

CALL NOW!!

800-576-2349

Fax (410) 987-3258

**Elite
Products**

Write in 200 on Reader Service Card.

Nuts & Volts Magazine/March 1996 77

Events

CALENDAR

MARCH 1996

MARCH 2

AL - TUSCALOOSA - Black Warrior Swapfest. Kelly Bruce 205-339-7882
CA - OAKLAND - Robert Austin Computer Show. Convention Center. 800-346-0100
CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
FL - FORT LAUDERDALE - Narisaam Computer Show. Holiday Inn-West. 800-436-6707
GA - COMER - NE Georgia Bubba Net Hamfest. Madison County Fairgrounds. Dan 706-742-2777
KY - GLASGOW - Mammoth Cave ARC Hamfest. Cave City Convention Center. Mark 502-651-8777
ND - BISMARCK - Annual Hamfest. Radisson Inn. Central Dakota ARC, POB 7162, Bismarck ND 58507
NH - TWIN MOUNTAIN - North County ARC & Littleton ARK Ham Radio/Computer Flea Market. Townhall. Richard Force 603-788-4428
NJ - ABSECON - Shore Points ARC "Springfest '96". Holy Spirit High School. SPARC, POB 142, Absecon NJ 08201

MARCH 2-3

OH - CINCINNATI - Computer Fair. Cincinnati Gardens. Mark Hanslip 513-263-3378

MARCH 3

CA - LIVERMORE - Swapmeet. Las Positas College. Noel Anklam 510-447-3857
FL - WEST PALM BEACH - Narisaam Computer Show. Palm Beach Airport Hilton. 800-436-6707
MA - BRAintree - South Shore ARC Ham Radio Flea Market. DAV #29 Hall. William 617-288-6906
MA - SWANSEE - Computer Show. Venus De Milo. Northern Computer Show 508-744-8440
MI - FLINT - Super Computer Show. Holiday Inn. Computers & You 313-283-1754.

MARCH 8-9-10

LA - LAFAYETTE - Acadiana Area Hamfest & ARRL State Convention. Holidome - Holiday Inn Central. Nolen Griffith, Jr 318-989-9039
NE - NORFOLK - ARRL State Convention. Patrick Adams 402-371-7295

MARCH 9

AZ - SCOTTSDALE - Scottsdale ARC Hamfest. Ron Reynolds 602-240-0473
CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves
CA - LOS ALTOS HILLS - Perham Foundation Electronics Flea Market. Foothill College, Parking Lot A. 408-734-4453
FL - LAKE WORTH - West Palm Beach ARC Semi-Annual Free Flea. John Prince Park @ Mound Circle. Marvin 407-683-2930
KS - COLBY - Trojan ARC Hamfest. Jim Robison 913-462-4548
KY - HAZARD - Kentucky Mountains ARC Hamfest. John Farler 606-436-5354
MI - LIVONIA - Super Computer Show. Elks Lodge Hall. Computers & You 313-283-1754.
ND - FARGO - Red River RAC Amateur Radio/Computer Fair. Red River Valley Fairgrounds. 701-282-2876
NH - PORTSMOUTH - Northern Computer Show. Frank Jones Center. 508-744-8440
NY - SYRACUSE - Computer Show & Sale. New York State Fairgrounds/International Bldg. Peter Trapp Shows 607-369-2796.
TX - VICTORIA - Swapfest 1996. Knights of Columbus Hall. Victoria ARC 512-573-0821
WA - PUYALLUP - Electronics Fleamarket. Pavilion Exhibition Hall, Western Washington Fairgrounds. Mike & Key ARC, 637 2nd Ave S, Kent WA 98032

MARCH 9-10

CA - SAN FRANCISCO - Robert Austin Computer Show. Cow Palace. 800-346-0100
NC - CHARLOTTE - Mecklenburg ARS Hamfest. Merchandise Mart. Mary Hunt 704-841-4267
NJ - PENNSAUKEN - KGP Computer Show. South Jersey Expo Center. 908-297-2526

MARCH 9-10-11

FL - ORLANDO - 50th Annual Orlando HamCation. Ken Christenson 407-291-2465

MARCH 10

IL - ORLAND PARK - Computer Show. Civic Center. 24-Hour Hotline 708-974-3123
IN - INDIANAPOLIS - Morgan County Repeater Assn. Hamfest. Brian Elliot 317-342-7236
ME - AUGUSTA - Northern Computer Show. Augusta Armory. 508-744-8440
MI - GRAND RAPIDS - Super Computer Show. Crown Plaza. Computers & You 313-283-1754.
NY - LINDENHURST - Great South Bay ARC/
Suffolk County RC Hamfest. Andy 516-928-3868
OH - CIRCLEVILLE - Teays ARC Computer/Hamfest. Amvets Hall. Roy Ulko 614-477-2771
OH - CONNEAUT - 10th Conneaut ARC Hamfest. Human Resource Center. Jack Martilla 216-593-3353
WI - WAUKESHA - Sewfars Swapfest. Expo Center Arena. Southeastern Wisconsin FM ARS 414-789-1034

MARCH 12-13-14

CA - LOS ANGELES - Computer Telephony Conference. Convention Center. 212-691-8215

MARCH 15-16

AR - LITTLE ROCK - Hamfest & ARRL State Convention. Expo Center. Jim 501-246-6734

MARCH 16

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052
FL - ENGLEWOOD - Englewood ARS HAMCOM '96. Dennis Babcock 941-698-0248
GA - MARIETTA - Kenehoochee ARC Hamfest. Margaret Durham 770-977-4405
MI - MARSHALL - 35th Annual Crossroads Hamfest. Marshall High School. SMARS 616-979-3433
NH - HUDSON - Interstate Repeater Society Hamfest. John Brunelle 603-881-5796
NH - SALEM - Northern Computer Show. Rockingham Park Track. 508-744-8440
NJ - PHILLIPSBURG - Micro Mart Computer Show. Holiday Inn. 609-924-2344
PA - WILKES-BARRE - Computer Show & Sale. Woodlands Inn. Peter Trapp Shows 607-369-2796.

MARCH 16-17

FL - FORT WALTON BEACH - Playground ARC Ham/Swapfest. Fairgrounds. Bud 904-243-5404
GA - PERRY - Middle Georgia Computer Show. Georgia National Fairgrounds & Agricenter. ComputerShow 770-907-6225
NJ - WAYNE - KGP Computer Show. William Paterson College, Recreation Center. 908-297-2526
TX - MIDLAND - Midland ARC Hamfest. Larry Nix 915-699-5441

MARCH 17

MA - STURBRIDGE - Northern Computer Show. Sturbridge Host Hotel. 508-744-8440
MI - FLINT - Computer Show. Holiday Inn-Gateway Centre. Five Star Productions 810-230-0988
MI - MADISON HEIGHTS - Super Computer Show. Uf & CW Hall. Computers & You 313-283-1754.
MI - NOVI - Great Lakes Computer Expo. Sheraton Inn. 313-416-1015
OH - MAUMEE - Toledo Mobile Radio Assn Hamfest/Computer Fair. Lucas County Recreation Center. Brian, 4463 Holly Hill Dr, Toledo OH 43614
OR - MILTON-FREEWATER - Walla Walla Valley ARC Hamfest. David 509-525-2529
PA - DOVER - 9th Keystone VHF Club York Springfest. Dover Firehall. Ted Rodes 717-259-8063
PA - MONROEVILLE - Two Rivers ARC Hamfest/Computer Fair. Greater Pittsburgh Expo Mart. TRARC, POB 225, Greenock PA 15047
PA - YORK - Keystone VHF Club Hamfest. John Shaffer 717-764-4805
WI - JEFFERSON - Tri-County Arc Hamfest. Jefferson County Fairgrounds. TCARC 414-563-6502

MARCH 23

FL - STUART - Martin County ARA Hamfest. Martin County Fairgrounds. Dave 407-288-7100
FL - SEBRING - 3rd Highlands County ARC Hamfest. National Guard Amory. Clyde 941-453-7181
IL - KANKAKEE - The Kankakee River Valley

Computer Users Group Computer Expo. County Fairgrounds, Main Bldg. Gary Johnson 815-935-1605
IN - INDIANAPOLIS - AGI Computer Fair. Beech Crest Center. 317-299-8827
MA - BOSTON - Northern Computer Show. Boston College High School. 508-744-8440
MI - CANTON - Great Lakes Computer Expo. Summit on the Park. 313-416-1015
MO - KANSAS CITY - Ararat AR Shrine Club Hamfest. Roger Bessmer 816-842-0400
NJ - WEST ORANGE - Irvington-Roseland ARC Hamfest. West Orange High School. 201-402-6066
PA - BETHLEHEM - Computer Show. Lehigh Univ/Stabler Arena. Peter Trapp Shows 607-369-2796.

MARCH 23-24

AL - HUNTSVILLE - ComputerShow. Von Braun Civic Center. ComputerShow 770-907-6225
OK - TULSA - Green County Hamfest & ARRL Section Convention. Maxwell Convention Center. Merlin Griffen 918-272-3081
PA - FORT WASHINGTON - KGP Computer Show. EXPO Center. 908-297-2526

MARCH 24

CA - SAN DIEGO - Computer Show. Convention Center. 619-295-1221
IL - GLEN ELLYN - Computer Central. Harper College. 708-940-7547
IL - STERLING - 36th Annual Sterling-Rock Falls ARS Hamfest. Sterling High School Fieldhouse. Lloyd 815-336-2434
IL - TAYLORSVILLE - Christian County ARC Hamfest. Taylorville Jr High School Gym. Walter Harwell 217-287-2010
MI - ANN ARBOR - Colossal Computer Sale. Washtenaw Community College. 313-971-0990
MI - DEARBORN - Super Computer Show. Civic Center. Computers & You 313-283-1754.
MI - MIDLAND - Computer Show. Holiday Inn. Five Star Productions 812-230-0988
NJ - TRENTON - Hamcomp '96. Trenton State College, Student Recreation Center. Delaware Valley Radio Assn Hotline 609-882-2240
NY - YONKERS - WECAfest. Yonkers Raceway. Thomas Rafaelli 914-741-6606
PA - ASTON - Camera & Video Show. Neumann College Life Center. Adam Rifkind 610-527-5903
PA - YORK - Computer Show & Sale. York Fairgrounds. Peter Trapp Shows 607-369-2796.
OH - MADISON - Lake County ARA Hamfest. Roxanne 216-256-0320
WV - CHARLESTON - Hamfest & Computer Show. Civic Center. Jimmie Hewlett 304-768-1142

MARCH 29-30

GA - COLUMBUS - Columbus ARC Hamfest. Randy Hancock 706-596-8820

MARCH 29-30-31

CO - GOLDEN - 5th Annual ENTCOM. Denver Marriott West Hotel. Midnight Engineering Magazine 719-254-4558

MARCH 30

CT - WATERFORD - Radio Amateur Society of Norwich's Ham Radio Auction. Senior Center. Tony 203-859-0162
FL - FANNING SPRINGS - Dixie ARK Darkfest '96. Suwannee River Fair & Livestock Assn Bldg. Glenda Filippini 904-542-3033
IN - COLUMBUS - Columbus ARC Hamfest. Bartholomew County 4-H Fairgrounds, Community Bldg. Marion Winterberg 812-342-4670
KY - ELIZABETHTOWN - 17th Annual Lincoln Trail ARC Hamfest. James R. Pritchard Community Center. LTARC, POB 342, Vine Grove KY 40175
MI - MICHIGAN CITY - Michigan City ARC Hamfest & Computer Flea Market. Michigan City High

All listing information should be sent to:

Nuts & Volts Magazine Events Calendar

430 Princeland Court

Corona, CA 91719

Phone 909-371-8497

Fax 909-371-3052

CompuServe 74262,3664

Internet

74262.3664@compuserve.com

School. Ron Stahovick 219-872-6594

MI - TAYLOR - Super Computer Show. Democratic Club. Computers & You 313-283-1754.

MI - WESTLAND - Great Lakes Computer Expo. Wayne-Ford Civic Center. 313-416-1015

NJ - UPPER SADDLE RIVER - Chestnut Ridge Radio Club Flea Market. Saddle River Reformed Church, Education Building. Andy 201-261-3783

OH - AKRON - Computer Show & Sale. Tadmor Shrine Temple. Peter Trapp Shows 607-369-2796.

TN - TULLAHOMA - Middle Tennessee ARS Hamfest. Ernest Moore 615-728-9473

TX - WEATHERFORD - ARC of Parker County Hamfest. Bob Sonnenberg 817-594-1017

VA - VIRGINIA BEACH - Computer Show. Pembroke Hall. Pro Am Shows 804-463-1136

MARCH 30-31

GA - NORCROSS - Atlanta ComputerShow. North Atlanta Trade Center. ComputerShow 770-907-6225

MD - TIMONIUM - Baltimore ARC Hambooree/Computerfest & State Conv. Timonium Fairgrounds. William Dobson 410-426-3378

MARCH 31

CA - SANTA ANA - Swapmeet. ACP Parking Lot. Mary Russo 714-558-8813

CT - SOUTHTON - Southington ARA Flea Market. Southington High School. Chet 860-628-9346

IL - GRAYSLAKE - Libertyville/Mundelein ARS LAMARSFEST '96. Lake County Fairgrounds. Frank Avellone 708-234-4124

NC - KINSTON - Down East Hamfest. Lenior County Fairgrounds. Jean DuPree 919-524-5724

OH - YOUNGSTOWN - Computer Show & Sale. Holiday Inn. Peter Trapp Shows 607-369-2796.

VA - NEWPORT NEWS - Computer Show. Knights of Columbus Hall. Pro Am Shows 804-463-1136

APRIL 1996

APRIL 5-6

AL - ALBERTVILLE - Marshall County ARC 5th SandMountainFest. Recreation Center. Buddy Smith 205-593-2516

APRIL 5-6-7

GA - AUGUSTA - Garden City Channel Masters CB Club 14th Annual Break. Radisson Hotel. Moses 706-793-7828

APRIL 6

CA - OAKLAND - Robert Austin Computer Show. Convention Center. 800-346-0100

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

CO - LONGMONT - LARCFEST. Boulder County Fairgrounds. Longmont ARC, POB 86, Longmont CO 80502-0086

MI - WATERFORD - Super Computer Show. NOCC CAI Building. Computers & You 313-283-1754.

PA - PHILADELPHIA - Micro Mart Computer Show. Holiday Inn. 609-924-2344

SC - AIKEN - Aiken Contest Club Hamfest & Computer Show. Aiken County Jaycee Fairgrounds. Doug 803-648-4754

TX - WICHITA FALLS - Wichita ARS Hamfest. Jimmy Dodson 817-586-0215

VA - VIRGINIA BEACH - Chesapeake ARS Springfest. Preston Ippock 804-543-4610

APRIL 7

CA - LIVERMORE - Swapmeet. Las Positas College. Noel Anklam 510-447-3857

APRIL 12-13

MS - TUPELO - Tupelo & Booneville ARC's Hamfest.

Events CALENDAR

Furniture Market, Mississippi Bldg. Jack Ellis 601-842-7255

OK - LAWTON - ARRL State Convention & Hamfest. Commanche County Fairground Coliseum. Robert Morford 405-355-6120

APRIL 13

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves

CA - HANFORD - Kings ARC Swapmeet. Fraternal Hall. Rick 209-945-2266.

CA - LOS ALTOS HILLS - Perham Foundation Electronics Flea Market. Foothill College, Parking Lot A. 408-734-4453

IN - INDIANAPOLIS - AGI Computer Fair. Beech Crest Center. 317-299-8827

KY - BOWLING GREEN - Kentucky Colonels ARC Hamfest. Leon Garrett 502-842-5307

ME - PORTLAND - Portland Amateur Wireless Assn Hamfest. University of Southern Maine, Sullivan Gym. Marty Feeney 207-839-5072

MO - JOPLIN - Joplin ARC Hamfest. Andy Gabbert 417-673-8371

OH - JACKSON - Jackson County ARC Hamfest. Dan Moore 614-286-6870

PA - FREDERICKSBURG - Appalachian AR Group Hamfest. Mark Schropp Jr 717-754-7700

VA - GOOCHLAND - Six Meter Ham Radio Team Swapfest. County Fairgrounds, Buddy 540-894-0406

VA - VIRGINIA BEACH - Computer Show. Independence Hall. Pro Am Shows 804-463-1136

WA - SPOKANE - Inland NW Hamfest. Al Lafky 509-924-3475

APRIL 13-14

CA - SAN FRANCISCO - Robert Austin Computer Show. Cow Palace. 800-346-0100

OK - MOORELAND - Northwest ARA Hamfest. Bill Wyatt 405-256-3248

TN - NASHVILLE - ComputerShow. Tennessee State Fairgrounds. ComputerShow 770-907-6225

APRIL 14

MA - FRAMINGHAM - Framingham ARA Ham, Radio, Electronics Flea Market. Framingham High School. Martin Bayes 508-435-0564.

NC - RALEIGH - Raleigh ARS Hamfest, Convention & Computer Fair. NCS Fairgrounds, Jim Graham Bldg. Rollin Ransom 919-269-4406

NE - OMAHA - Ak-Sar-Ben ARC Hamfest. Todd 402-397-7465

NJ - NEWARK - Micro Mart Computer Show. Holiday Inn. 609-924-2344

PA - ALLENTOWN - Computer Show. Leesport Farmers Market. Peter Trapp Shows 607-369-2796.

VA - NEWPORT NEWS - Computer Show. Knights of Columbus Hall. Pro Am Shows 804-463-1136

WI - MADISON - Madison Area Repr Assn Hamfest. Dane County Expo Center. Jim 608-245-8890

APRIL 19-20-21

CA - VISALIA - ARRL Int'l DX Convention. Don Bostrom 818-784-2590

APRIL 20

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

FL - MIAMI - University of Miami ARC & Flamingo Net Tailgate/Swapmeet. University of Miami Parking Lot #102. Bill, 73 Palm Ave., Miami Beach FL 33139

MI - MUSKEGON - Muskegon County ARES/RACES Hamfest. Tom Vander Mel 616-733-2963

MN - FERGUS FALLS - Lake Region ARC Hamfest. William Morgan 218-736-4448

PA - HARRISBURG - Computer Show. Farm Show Complex. Peter Trapp Shows 607-369-2796.

TX - BELTON - Temple ARC Ham Expo/Tailgate. Bell County Expo Center. Mike 817-773-3590

APRIL 20-21

AL - BIRMINGHAM - State Convention. James Pilman 205-970-0737.

GA - ATLANTA - ComputerShow. Cobb County Civic Center. ComputerShow 770-907-6225

NJ - WEST WINDSOR - Trenton Computer Festival. Mercer County College. TCF '96 717-529-6134

APRIL 21

CA - SONOMA - Valley of the Moon ARC Hamfest. Veteran's Memorial Building. Darrell 707-996-4494

DE - NEWCASTLE - Penn-Del ARC Hamfest. Nur Temple. Hal Frantz 302-798-7270

IL - ARTHUR - Moultrie ARK Hamfest. Moultrie/Douglas County Fairgrounds. Ralph 217-873-5287

IL - ORLAND PARK - Orland Park Computer Show. Civic Center. 24-Hour Hotline 708-974-3123

MA - CAMBRIDGE - Flea Market. MIT. Nick 617-253-3776

MI - FLINT - Computer Show. Holiday Inn-Gateway Centre. Five Star Productions 810-230-0988

APRIL 27

IA - DES MOINES - Des Moines RAA Hamfest. Carmi Smith 515-262-5478

ID - LEWISTON - Clearwater Valley & Camas Prairie ARC's Hamfest. Dennis Burgess 509-758-5343

KY - OWENSBORO - Owensboro ARC Hamfest. Daviess County Fairgrounds. Steve 502-926-4451

MI - WESTLAND - Great Lakes Computer Show. Wayne-Ford Civic Center. 313-416-1015

MN - SHAKOPEE - SMARTS Radio Club SMART-FEST. Canterbury Downs. Dave 612-445-8071

MT - BUTTE - Butte ARS Hamfest. Bob Evans 406-494-3066

NY - SYRACUSE - Liverpool ARC Hamfest. Larry Taft 315-668-8219

OR - ROSEBURG - Umpqua Valley ARC Amateur Radio & Computer Show. Douglas County Fairgrounds. Ed Pahl 503-673-1310

SD - HURON - Huron ARC Swapfest. National Guard Armory. Lloyd Timperley 605-352-7896

WA - VANCOUVER - Clark County ARC Hamfest. Wayne Schuler 360-896-8909

WV - FLATWOODS - Pioneer ARC Hamfest. Ed Messenger 304-462-5312

APRIL 27-28

FL - GAINSEVILLE - Hamfest & Computer Show. Alachua County Fairgrounds. Bill 904-454-3105

KY - LOUISVILLE - Computer Fair. Kentucky Fair & Expo Center. Mark Hanslip 513-263-3378

APRIL 28

IL - CHICAGO - Chicago ARC Ham Auction. DeVry Institute of Technology. George 312-545-3622

IL - GLEN ELLYN - Computer Central. College of DuPage, Phys Ed Bldg. 708-940-7547

MI - GROOSE POINT WOODS - Southeastern Michigan ARA Hamfest. North High School. Thomas 313-527-3497

NJ - BUDD LAKE - Northwest Jersey Hamfest. Budd Lake Firehouse. 201-584-6550

NY - POUGHKEEPSIE - Mt. Beacon ARC Hamfest. Ken Akasofu 914-485-9617

OH - ATHENS - Athens County ARA Hamfest. City Recreation Center. Drew McDaniel 614-592-2106

MAY 1996

MAY 3-4-5

CA - LA MIRADA - So Calif Six Meter Club West Coast VHF/UHF Conference. 714-990-9203

MAY 4

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

IN - INDIANAPOLIS - AGI Computer Fair. Beech Crest Center. 317-299-8827

MD - GRASONVILLE - Kent Island ARC Hamfest/Computer Flea Market. VFW. Glenn 410-643-1125

MO - KANSAS CITY - PHD ARA Hamfest. Chuck Miller 816-781-7313

OR - KLAMATH FALLS - Keno ARC Hamfest. Tom Hamilton 541-883-2736

SC - GREENVILLE - Blue Ridge ARS Hamfest. Anderson County Fairgrounds. Jeff 864-967-3284

WI - SUPERIOR - Arrowhead RAC Hamfest. George Mead 218-729-6882

MAY 4-5

CA - SAN FRANCISCO - Robert Austin Computer Show. Cow Palace. 800-346-0100

GA - DALTON - ComputerShow. NW GA Trade & Convention Center. ComputerShow 770-907-6225

TX - ABILENE - Key City ARC Hamfest & ARRL Section Convention. Civic Center. Peg 915-672-8889

MAY 5

CA - LIVERMORE - Swapmeet. Las Positas College. Noel Anklam 510-447-3857

IL - DECATUR - Cenois ARC Hamfest. Richland Community College. Bert Ruble 217-423-0314.

IL - SANDWICH - Kishwaukee ARC Hamfest. Sandwich Fairgrounds. Howard, POB 264, Sycamore IL 60178

IN - WABASH - Wabash County RC Hamfest. Donald Spangler 219-563-5564

MD - HAGERSTOWN - Antietam Radio Assn Hamfest. Bill Harclerode 304-274-3355

MI - MIDLAND - Computer Show. Holiday Inn. Five Star Productions 812-230-0988

MN - BEMIDJI - Paul Bunyon ARC Hamfest. NorthWest Technical College. Roben 218-751-4801

NY - YONKERS - Metro 70cm. Network Flea Market. Lincoln High School. Otto 914-969-1053

OH - AKRON - Computer Show & Sale. Tadmor Shrine Temple. Peter Trapp Shows 607-369-2796.

PA - WRIGHTSTOWN - Warminster ARC Hamfest. Middletown Grange Fairgrounds. 215-443-5656

MAY 11

CA - FONTANA - Inland Empire ARC Amateur Radio & Electronics Swapmeet. A B Miller High School. Bill 909-822-4138 eves

CA - LOS ALTOS HILLS - Perham Foundation Electronics Flea Market. Foothill College, Parking Lot A. 408-734-4453

CA - OAKLAND - Robert Austin Computer Show. Convention Center. 800-346-0100

IL - PEOTONE - Kankakee ARS Annual Hamfest. Will County Fairgrounds. Willis 815-472-2079

WI - MANITOWAC - Mancorad ARC Lakeshore Hamfest. County Expo Center. Glenn 414-684-7096

MAY 12

OH - MEDINA - Medina 2 Meter Group Hamfest. Robert Romaniello 216-722-6019

PA - YORK - Computer Show & Sale. York Fairgrounds. Peter Trapp Shows 607-369-2796.

MAY 17-18-19

OH - DAYTON - Dayton ARA Hamvention. Dayton Hara Arena & Exhibition Center. 513-276-6930

MAY 18

CA - SANTEE - ARC of El Cajon Ham, Computer & Electronic Swapmeet. Santee Drive-in. 619-561-0052

MI - WESTLAND - Great Lakes Computer Expo. Wayne-Ford Civic Center. 313-416-1015

PA - ALLENTOWN - Computer Show. Merchants Square. Peter Trapp Shows 607-369-2796

RI - FORESTDALE - Rhode Island Amateur FM Repeater Service Spring Auction & Flea Market. VFW Post 6342. Rick 401-725-7595

MAY 18-19

WA - YAKIMA - Yakima ARC Hamfest. Mark Tharp 509-965-3379

VA - NEWPORT NEWS - Computer Show. Knights of Columbus Hall. Pro Am Shows 804-463-1136

MAY 19

CA - CARMICHAEL - North Hills ARC Hamfest. Tim Lewis 916-722-7037

IL - ORLAND PARK - Orland Park Computer Show. Civic Center. 24-Hour Hotline 708-974-3123

MA - CAMBRIDGE - Flea Market. MIT. Nick 617-253-3776

MI - FLINT - Computer Show. Holiday Inn-Gateway Centre. Five Star Productions 810-230-0988

VA - VIRGINIA BEACH - Computer Show. Pavilion. Pro Am Shows 804-463-1136

MAY 25-26

CA - SAN FRANCISCO - Robert Austin Computer Show. Cow Palace. 800-346-0100

MAY 26

CA - SANTA ANA - Swapmeet. ACP Parking Lot. Mary Russo 714-558-8813

IL - CHICAGO - Chicago ARC Annual Hamfest. DeVry Institute of Technology. Jack 312-736-1587

IL - GLEN ELLYN - Computer Central. College of DuPage, Phys Ed Bldg. 708-940-7547

OH - CANFIELD - 20/9 Radio Club Hamfest. Canfield Fairgrounds. Don Stoddard 216-793-7072.

MAY 31-JUNE 1

NE - SOUTH SIOUX CITY - Midwest & Dakota Division Convention. Dick Pitner 712-258-1520

MAY 31-JUNE 1-2

NY - ROCHESTER - Atlantic Division/New York State Convention. Harold Smith 716-424-7184

Are you missing any
issues of Nuts & Volts?

Back issues are available
for only \$5.00 each!

Call our orderline at
800-783-4624 and use
your Visa or MasterCard.

Price includes
First class postage.

Metric
Equipment Sales, Inc.

800-432-3424

Fax: 415-341-8874

E-mail: metricsale@aol.com

RENT • BUY • SELL
Yes, we will buy your surplus equipment!

Scopes, Meters, Analyzers, Power Supplies, Signal
Generators, Counters, Recorders and more

Hewlett-Packard, Tektronix, Fluke, Dranetz, TTC, Anritsu,
Wavetek, Keithley, and more

Test & Measurement Instruments

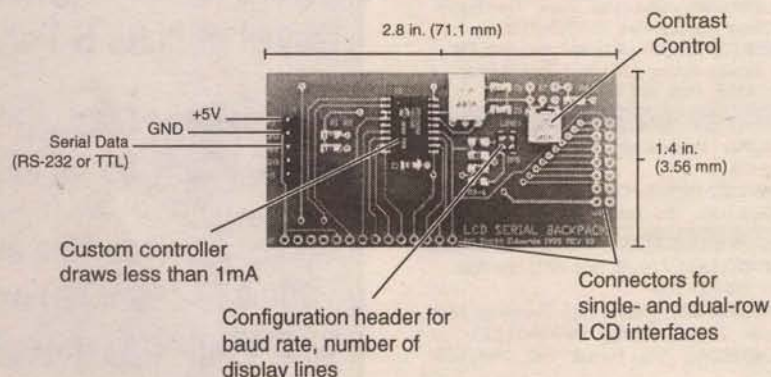
Over 7000 Models • 6-Month Warranty
Save 30-90% • 5-Day Free Trial

Serial LCD Modules

An LCD display makes your project or product easier to use and more attractive. But interfacing LCDs can create programming hassles and an ugly rat's nest of wires.

An interface for everything, and everything in the interface:

The LCD Serial Backpack is a tiny daughterboard that converts any LCD, from 1x8 to 4x20 characters, into a serial device. Just connect 5-volt power and send data via RS-232 to the Backpack at 2400 or 9600 baud. Easy programming, three wires, that's it.



Circuit boards or complete modules. The Backpack is available as an assembled, surface-mount daughterboard ready to mount on your LCD. Installation kit included. Price \$29.

We also offer three Backpack-equipped LCDs:

- Economy 1x16 from manufacturers' surplus: \$40.
- New 2x16 with high-contrast supertwist technology: \$45.
- Deluxe 4x20 supertwist with LED backlight: \$89.

All Backpack packages include complete instructions, program examples, and hints for use with BASIC Stamps 1 and 2, and PCs. The Backpack works great with other computers and controllers, including the exciting new Domino from Micromint.



We offer other electronic products and kits, including Stamp-1 clone kits (Counterfeit Controller), Stamp and PIC programming information, servo controllers, and electronic hobby kits. Call or write to receive our new catalog free by mail.

Scott Edwards Electronics

Add \$3 for shipping to the U.S. and Canada. We accept Visa, Mastercard, and American Express. Personal/company checks OK for mail orders. CODs incur a \$7 handling fee.

Scott Edwards Electronics • 964 Cactus Wren Lane • Sierra Vista • AZ • 85635
ph: 520-459-4802 • fax: 520-459-0623 • e-mail: 72037.2612@compuserve.com

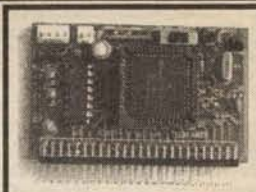
BASIC Stamp is a registered trademark of Parallax Inc.

ADAPT-11 68HC11 Module for Solderless Breadboards

- miniature 2.0" by 2.8" module
- plugs vertically into solderless breadboard
- has reset circuit, pushbutton, & mode select switch
- RS-232 interface, 5V regulator & external power connector
- all I/O signals brought out to dual row, breadboard-compatible header
- doubles as programmer for 68HC711E9 (12K EPROM version)

ADAPT-11
from \$40
(micro extra)

Quickly becoming
the tool of choice
for universities,
schools, engineers &
hobbyists...



NEW PRODUCT!
ADAPT-11/75 module
adds support for Xicor X68C75
(8K EPROM + dual I/O ports)
from \$49 (w/o HC11 or C75)

Starter Package comes with ADAPT-11 module, 68HC811E2 micro-controller with 2K EPROM on-chip (re-programmable in circuit 1000s of times; no EPROM programmer or eraser required), PC serial cable for downloading code, Motorola Programming Reference Guide, ADAPT-11 User Manual, freely distributable 68HC11 software, and demo program. #AD11-SP \$74.95 + \$5 shipping & handling.

ADAPT-11 EXPANSION:

- Backplane for ADAPT-11 plus 3 cards (add memory & I/O for serious applications)
- 32K RAM + 32K EPROM/EEPROM
- prototyping card for adding your circuitry

MasterCard
Accepted

68HC811E2FN
68HC711E9FS
68HC11E0FN

Use PLCs in your Solderless Breadboard!
Solderless breadboard socket adapters for all popular
PLCC sizes, starting at \$13.95. Vertical design.

Also available:
Solderless breadboard adapters for DB9 & DB25, and
IDC (ribbon cable) connectors, from \$3.75.

Terms: MasterCard,
Check, Money Order.
School & Government
P.O.s accepted

All prices in US dollars.

TECHNOLOGICAL ARTS

309 Aragona Blvd., Suite 102, Box 418, Va. Beach, VA 23462
1644 Bayview Avenue, Box 1704, Toronto, ON M4G 3C2
voice/fax: (416) 963-8996 www.io.org/~techart

Write in 44 on Reader Service Card.

CABLE TV cont.

PROGRAMMERS BY AMS, TRIBAL & XEL-TEK E(P)ROMS, Flash, GALs/ micros \$125 up. Systems including PICs & erasers. 24 hr. FREE BBS updates for clients. **History: 24 yrs. client satisfaction. TRIANGLE PRODUCT DISTRIBUTORS USA**, 5750 Lakeshore Dr., Holland, MI 49424. 616-399-6390. M-F 9am to 2pm EST.

WANTED TO BUY: Scientific Atlanta 8590 and 8600 cable boxes new or used. Paying top dollar. 423-870-2600.

ATTENTION DEALERS. Stealth @ 35. Stealth-SA @ 50. New Pio @ 55. 10 lot or more. 702-895-9120.

PIONEER NO E-4 TEST MODULE BLOWOUT! \$15 ea. minimum 5. Master files for Pioneer \$325. All other master files available. Test modules for Scientific Atlanta, Zenith, Pioneer also available. 1-800-MODULE-0.

YOU'LL NEVER have to leave the comfort of your chair with this infrared remote control video A/B switch. Control by any remote. Also notch filters, interference filters. 405-631-5153.

SCIENTIFIC ATLANTA refurbished in full test mode. With remote. 8500-320 8500-321 8535-430 \$100. Plus \$3 shipping 30 day warranty. Limited quantity. COD only. 412-833-0773.

ZENITH ST1600 wholesale prices guaranteed best price one year warranty 1-800-406-0071.

MASTER FILES. Now available the complete set of S/A programming files. 8500-8600. 40-pin as well as PIC "Quick boards." Plus some bonus files. Call 312-213-7023 we have many other products not mentioned!

CABLE TV ZAPPER ELIMINATOR and ID BLOCKER COMBO. Electronically shields yourself and your box. Factory direct. **LIFE-TIME GUARANTEE.** All orders shipped same day received. **1 @ \$14 EACH. \$9 each additional.** NS Electronics, 2810 SE Federal Hwy., Dept. #2, Stuart, FL 34994.

QUICK BOARDS \$15 w/multimode & map. 5 and 7000s, FCT-2200s, Pio no E4s & SAs. **E2 CLEARER/TEST AID** 63/67s (no ser #s or writer needed) \$15. **SA MICROS** \$20. **ACTIVATOR TAPES** Zenith and 03/07/08 \$25; **DIAGNOSTIC TRANSMITTERS** 5 and 7000s (w/30 day charge) \$85, Pio & SA programmables \$110; **FREQUENCY FILTERS** \$20; **REMOTES** \$10; **SECURITY BITS** \$10. 718-241-2560 8am-1pm Est. No NY sales!

CABLE HACKERS! Blowout sale! All new cable hackers handbook \$25.95. Also build your own descrambler for under \$50! 4 different designs! Works on any system guaranteed! Easy to build! Plans only \$15! Wow! Bates, 733 N. Wells, Chicago, IL 60610.

ONE PIECE cable box with 100 channels Pioneer #6350 or below, Scientific Atlanta #8600 and below, Zenith 10 lots \$145 each. 20 lots \$135 each. 50 lots \$125 each. 702-732 0717.

DSS CARD FIX-Simply replace your existing card, with this product, and it will enable all channels, including pay-per-views. New improved model works on all makes of DSS receivers. With your order, you will receive our new after-market card, full instructions, and access to our technical support hot-line. Send \$249 US to Flaire Technologies, 1950 E. Greyhound Pass, Suite #18-182, Carmel, IN 46033-7730.

PIONEER 6310, 6110, 5130, SA 8600. Zenith 1600 and many other units. Call for prices on units. J and J Electronics 1-800-779-3585.

RAW UNITS dealers. Z1600 @ 150, Z1000 @ 85. VIP 5507 @ 150. All units raw. Guaranteed working. 702-895-9120.

PIONEER UNITS 5XXX-63XXX units. Call for prices. E2-E5 test aids for 5XXX-61XX \$30 ea. 63XX-67XX test aids with # \$35 ea. All no E4. New Watch Dog, no switches, auto map \$35 ea. E2-Writer \$50. RF transmitter for Pio \$150. Pio box repairs. SA-40 pin ++ 8570-8600 \$34 ea. Other test aids \$20-\$35 ea. for compatible boxes. Call 216-428-6910.

OAK SIGMA full access test modules! See our ad on page 74. X. E. 908-969-2088 24 hr.

OAK SIGMA, schematics, master files, equipment. Call 719-661-1659 for free Sigma catalog.

CABLE CONVERTER diagnostic and test modules for sale. Internal and external. Call John 1-800-879-9657.

CABLE DESCRABLERS, Pioneer 6310s Scientific Atlanta 8580s, 8590s, and other major brands. We have low overhead so we can sell for less. 30-day money back guarantee. Call anytime. Houston, TX. 713-691-4610.

PIONEER 6310 boxes \$250. Also low prices on other cable units. Magic Communications, 805-944-6865. No CA sales.

"BASEBAND VIDEO EXPLAINED." Discover what a Baseband Signal is and how it's constructed. Learn the advantages of doing things the "Baseband" Way. \$10. Visa/MC/Amex. **ELECTROMAN**, Box 24474, New Orleans, LA 70184. 504-482-3017.

\$6 LOADER master files for EPROM and GAL, PCB pattern, construction and operating instructions, rewrites RAM in RF or baseband units, easy to build, \$35. Ponderosa, 3624 Citadel Drive North #330, Colorado Springs, CO 80909.

CATV BLOWOUT Sale. Dealers only, 10 lot pricing. MS-80 pan \$45. 86 baseband pan \$55. Boss-Trimode \$125. Boss-Pio \$145. Boss Z-Tac \$190. Boss T \$190. Boss-86 baseband \$190. 8600 orig. \$255. 423-922-1441.

STEALTH FSK: EXTERNAL TEST DEVICE FOR THE "BIG ONE." BATTERY OPERATION. WORKS ON ALL THREE FREQ. NO ADJUSTMENT NEEDED. EVER. FULL TEST IN JUST 5 SECONDS. \$125 EACH. QUANTITY DISCOUNTS AVAILABLE. MARC, 1-800-249-4998.

B & S SALES

(810) 566-7248

FAX (810) 566-7258

"Your satisfaction is our main goal"

COMBINATION:

SP-PLUS

10 Price

\$195.00

One piece Panasonic converter model TZPC175DG2 to replace Scientific Atlanta or Pioneer models. Volume control, sleep timer, standard/HRC switchable, and parental lock.

TP-PLUS

\$195.00

One piece Panasonic converter model TZPC175DG2 to replace Tocom models. Volume control, sleep timer, standard/HRC switchable, and parental lock.

ZP-PLUS

\$195.00

One piece Panasonic converter model TZPC175DG2 to replace Zenith models. Volume control, sleep timer, standard/HRC switchable, and parental lock.

CONVERTERS:

PANASONIC TZPC1453G2

10 Pc

\$69.00

20 Pc

\$67.00

"Top of the Line" converter featuring sleep timer, standard/HRC switchable, parental lock, last channel recall, favorite channel memory, and 83 channel capability.

PANASONIC TZPC1003

\$64.00

\$62.00

One of our best selling converters featuring sleep timer, parental lock, last channel recall, favorite channel memory, and 80 channel capability.

CENTURY

\$62.00

\$60.00

New straight converter with 99 channel capability. Featuring sleep timer, parental lock, last channel recall, favorite channel memory, and standard/HRC switchable.

DESCRAMBLERS:

	10 Pc	20 Pc		10 Pc	20 Pc
PGWS	\$63.00	\$57.00	STEALTH	\$47.00	\$42.00
M-80	\$63.00	\$57.00	J-7	\$42.00	\$40.00
TNT	\$63.00	\$57.00	TVT-3G	\$40.00	\$37.00
PURPLE	\$49.00	\$44.00	MINI TVT	\$40.00	\$37.00
GREEN	\$63.00	\$57.00	BROWN	\$63.00	\$57.00

NO MICHIGAN SALES

SALES REPRESENTATIVES AVAILABLE MONDAY THRU FRIDAY 8:30 A.M. EST TO 5:30 P.M. EST
AND SATURDAY 10:00 A.M. TO 4:00 P.M. EST.

Electronic Kits



A sample of available kits:

- > Sound-Activated FM Transmitter \$8.95
- > Electronic Dice\$10.95
- > Logic Probe\$14.95
- > Ultrasonic Motion Detector ...\$29.95
- > Digital LCD Thermometer\$29.95
- > Fiber Optic Audio Link\$34.95
- > Eeprom Emulator\$84.95

For a complete listing of all our products call for a **FREE** catalog.

Berger's Electronics

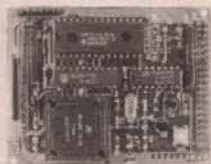
Fax: 1-510-229-3441

Tel: 1-800-588-KITS

Write in 160 on Reader Service Card.

OEM WME2

68HC11 Based Micro-Controller

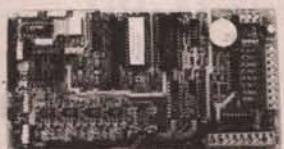


- STANDARD FEATURES**
- Supports A and E Series HC11's.
 - Single 5 Volt Supply Operation.
 - 32K x 8 On-Board RAM.
 - 9.8304 Mhz Crystal Oscillator.
 - Serial Host / Reload Port.
 - Supports ALL HC11 Operating Modes.
 - Designed for easy Board-Stacking.
 - Full Reset/Power Supply Management.
 - Tiny 2.5 by 3.5 inch footprint.
 - RAM can be Battery Backed.
 - Easy Memory Banking Logic.

\$119 Plus \$5 S&H
Single Piece Price!

STAND ALONE WMS11

68HC11 Based Micro-Controller



- STANDARD FEATURES**
- FAST 9.83 Mhz Operation.
 - RS-232 Host Interface.
 - 32K RAM - 32K EPROM.
 - Trimable Crystal Oscillator.
 - Configurable Analog Input Buffers.
 - Buffered and Optically Coupled I/O.
 - Single Supply - Local Power Regulation.
 - Full Reset/Power Supply Management.
 - Battery Backup the RAM or Entire Board.
 - Banked Memory Logic allows up to 2Mhz.
 - Four Pre-Decoded Chip-Selects Available.
 - Buffalo Monitor Supplied on EPROM.
 - BASIC 1.1 and Real-Time Kernel Available.

\$159 Plus \$5 S&H
Single Piece Price!

Wheatstone MicroSystems, Inc.
3 Marine Avenue
Clinton, CT 06413
(203) 669-0401 fax (203) 669-2838

SWITCHES

MINIATURE TOGGLE SWITCHES @ 6 AMP

Part #	Type	Price Qty 100	Price Qty 1
600	SPST	\$56.00	\$0.68
601	SPDT	\$60.00	\$0.72
602	SPDT C/OFF	\$76.00	\$0.88
603	SPDT C/OFF (MOM)	\$76.00	\$0.88
604	DPDT	\$76.00	\$0.88
605	DPDT C/OFF	\$91.00	\$1.03
606	DPDT C/OFF (MOM)	\$91.00	\$1.03

MINIATURE TOGGLE SWITCHES COMPUTER GRADE

Part #	Type	Price Qty 100	Price Qty 1
501	SPDT	\$82.00	\$1.17
502	DPDT	\$120.00	\$1.55
503	3PDT	\$259.00	\$3.20
504	4PDT	\$324.00	\$4.00
505	SPDT C/OFF	\$106.00	\$1.40
506	DPDT C/OFF	\$141.00	\$1.75
507	3PDT C/OFF	\$282.00	\$3.50
508	4PDT C/OFF	\$351.00	\$4.55
509	SPDT C/OFF (MOM)	\$116.00	\$1.45
510	DPDT C/OFF (MOM)	\$150.00	\$1.85

LED'S

INDUSTRY STANDARD LED'S

Part #	Size	Diffused Color	Price Qty 100	Price Qty 25
801	3mm	RED	\$14.00	\$0.19
802	3mm	YELLOW	\$14.50	\$0.19
803	3mm	GREEN	\$14.50	\$0.19
804	5mm	RED	\$14.00	\$0.19
805	5mm	YELLOW	\$14.50	\$0.19
806	5mm	GREEN	\$14.50	\$0.19

13.8 Volt DC POWER SUPPLIES

Part #	Amps Constant	Amps Surge	Wattage	Unit Price
PS-6	4	6	90	\$35.95
PS-8	6	8	140	\$39.75
PS-10	10	—	320	\$172.70
PS-12	10	12	200	\$65.90
PS-22	20	22	400	\$119.90

• PS-10 ADJUSTABLE 0 TO 20 VDC
• ALL HAVE DUAL METERS EXCEPT #PS-6 & PS-8

Make all checks and money orders payable to MIS-CYN
Orders are shipped after checks clear. A minimum charge off \$5.50 will be added to all orders for shipping.

Mis-Cyn Electronics
7211 Olde Salem Cr.
Hanover Pk. IL 60103

VISA MasterCard

POWER SUPPLIES

Write in 121 on Reader Service Card.

CABLE TV cont.

2ND GENERATION FTGs, the Stealth FSK, complete auto operation, better than the RFT-1 \$145. Genesis Automode FSKs \$150. Super 2R/FTC test modules \$25. SLOPPY JOE'S 707-778-7488.

WANTED: TEST modules or fix for SA DMX music and SA Sega adapter. Call anytime if you can help. 702-892-9183.

BLANK COMPONENT PIC16C54 \$2; PIC56 \$2.30; Motorola 40 pin \$11; GAL 22V10 \$1.50; PAL 16L8B \$1.50; EPROM 27C64 \$2.25; 28 pin wire wrap socket. Pushbutton switches \$.30. All in stock. Tel 305-220-5384, FAX 305-220-9396.

WIRELESS CABLE dipole/feedhorn w/built-in cable ready downconverter and power supply \$125. About half price. 36 channels. 30dB gain "stinger" type. 512-259-4770. 10AM-6PM CST.

CABLE BOX PULLS. ST1000, 1086, & 1600. S/A 8500 310, 311, 321; 8550-xxx. Basic converters from \$15. Other brands available. Inventory changes constantly. Credit cards okay. Write or fax 501-223-9406 and request "Cable List" for latest inventory list. **Software City**, Box 23016, Little Rock, AR 72221.

WANTED TO BUY: Scientific Atlanta 8590 and 8600 cable boxes new or used. Paying top dollar. 423-870-2600.

NEW EMERSON 4-way universal remote control. Works on all major brands. 1 @ 14, 5 @ 12, 10 @ 10. More. Call 702-895-7580.

ZL1. THE MOST RELIABLE ZENITH COMPATIBLE TEST KIT. \$6 EACH COMPLETE WITH WIRES. 407-676-2530.

8580 COMPATIBLE \$150; Zenith (raw) or ready-to-go. Call for model #. 405-634-1535.

FOR SALE: DSE 1000 encoder, excellent condition, great for testing and repairing. Trimode and S/A converters and descramblers. \$1,500 or best offer. Call, 1-800-909-4333.

CABLE DESCRAMBLER KIT! Simple to build. Connects in seconds. Instructions and universal kit for all systems, \$19.95. Money back guarantee. 1-800-522-8053.

TELEPHONE/FAX

12 HOUR TELEREORDER complete unit. Records automatically and clearly all telephone conversations 12 hours on a single tape. Special offer just \$79 including shipping. Send cheque to Vakis Efthychiou, 1402 Pine Ave. #400, Niagara Falls, NY 14301. Dealers wanted.

ESN LOADER INTERFACE for Motorola bag phones (ver. 9122-94xx). Does all flips, micro-tacs, ultra-lites, pocket phones, ultra-classics, series three and four bag, install phones \$200, \$100 amps also! Uses standard programming cables and connects to your PC. Payment by US Postal Money Order. Call 512-259-4770. Keith Perry, PO Box 816, 607 Osage Drive, Leander, Texas. Internet: cia@paranoia.com

PANASONIC, SOUTHWESTERN BELL phones and professional security equipment catalog. Send \$2 to: HES Electronics, PO Box 183, Brick, NJ 08723.

NORTHERN TELECOMM #2960 telephone network interfaces (RID/MTU). \$3.25 each singles, \$2.45 tens, \$1.70 hundreds. Full docs available. SYNERGETICS SURPLUS, Box 809, Thatcher, AZ 85552. 520-428-4073. Visa/MC.



UJ'S® EMULATOR COMBO SALE (MARCH, APRIL, AND MAY) WITH PURCHASE, FREE: **MOTOROLA'S CELLULAR TECHNICIANS TROUBLESHOOTERS MANUAL** (212 PAGES, OCTOBER '95 \$49.95 VALUE). OFFER (1) MODEL UJME-1EE EMULATOR WITH 5 MODE CONTROL BOX, MAMPS-1EE-G2 SOFTWARE, AC POWER ADAPTER, INSTRUCTION MANUAL, TECHNICAL BACK-UP AND FREE: **MOTOROLA'S CELLULAR TECHNICIANS TRAINING MANUAL** \$369.95. **COMBO (A)** SAVE \$90. EMULATOR UJME-1EE WITH CHOICE 3 OF 5 INTERFACE CABLE HARDWARE SETS, PLUS BONUS: 4 POSITION DATA TRANSFER SWITCH, BENCH TYPE REGULATED POWER SUPPLY AND FREE: **MOTOROLA'S CELLULAR TECHNICIANS TRAINING MANUAL** \$674.95. **COMBO (B)** SAVE \$130: INCLUDES COMBO (A) BUT WITH ALL 5 INTERFACE CABLE HARDWARE SETS \$874.95. **COMBO (C)** SAVE \$175: INCLUDES COMBO (B), PLUS REFURBISHED DESKTOP PC 386-SX, 14" VGA COLOR MONITOR, KEYBOARD, 2MB RAM, 80MB HD, MATCHED UNIT, PROPERLY ADDRESSED, CONFIGURED & TESTED FOR EMULATOR OPERATION \$1,390, 386 MONOCHROME REFURBISHED LAPTOP SYSTEM, FULLY SELF-CONTAINED OPERATION AC OR BATTERY DC. (INCLUDES SAMSONITE ATTACHE CASE) \$1,790. NOTE: ALL UJ'S® SYSTEMS FEATURE UNLIMITED DATA TRANSFERS OF FIRMWARES TO 9525 BUT NOT 9525 ABOVE OR PRODUCT CODES EE2-EE3. S-H/COD/FEDEX/2ND DAY AIR (per order) EMULATOR, CABLE SETS, COMBO A OR B ADD \$24.95. **COMBO C** DESKTOP \$75, NOTEBOOK \$55. 1996 CATALOG, ORDERS, ETC., TELEPHONE 702-642-0325. **LESS BUSTER'S ELECTRONICS**, 2039 CIVIC CENTER DRIVE #176, N. LAS VEGAS, NV 89030.

FREE CALLS! Plans to build a red box using a Radio Shack tone dialer! Now affordable! Sells elsewhere for \$50, here only \$19.95. Bates, 733 N. Wells, Chicago, IL 60610.

PRIVACY AT LAST. Amazing new module gives you total privacy on your telephone conversations. Send \$29 to V. Efthychiou, 1402 Pine Ave., Niagara Falls, NY 14301.



CELLULAR HACKERS BLACK BOOK: Largest manual of its kind! Completely details how cellphones operate and are reprogrammed. Covers: Cloning, chip programming, reverse and forward channeling, ESN codes, NAMs and MINs, digital data interpreters, EPROMs, control data formats, scanning, frequencies and channel allocations, and much more! Includes **programming software** for Motorola, DiamondTel, Gateway, GE, Mitsubishi, NEC, Nokia, Novatel, Oki, Panasonic, Colt, Fujitsu, Goldstar, Radio Shack, Sony, and Uniden phones! Worth well over \$90. Yours for only \$25! **Spectre Press**, PO Box 5112, North Muskegon, MI 49445.

CELL PHONE cloning for the guy who has (two of) everything. Must have current service contract. Motorola, Tandy. For more info, call Keith, 512-259-4770.

WHOLESALE CABLE

CONVERTERS AND DESCRAMBLERS

- ☒ Quality merchandise by brand name manufacturers
- ☒ Satisfaction guaranteed
- ☒ Technical support
- ☒ 2 year warranty on new converters
- ☒ COD shipping & overnight shipping by request
- ☒ Experience where it counts

- ☒ Free gift on first order
- ☒ 1 year warranty on new descramblers
- ☒ Volume pricing

ADD-ON DESCRAMBLERS: TVT, FTB-3, STEALTH, SA-3, SA-3DF, M-80, PIO-GREEN, DMTBA, KN12, EAGLE PD-3, HAMLIN MLD-1200

COMBINATION DESCRAMBLER/CONVERTERS: PIONEER, SA, ZENITH, OAK, EAGLE, HAMLIN

PLAIN CONVERTERS: PANASONIC, SA, STARGATE

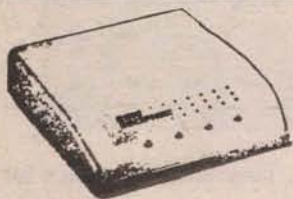
REMOTE CONTROLS: ALL MAJOR BRANDS, INCLUDING 2-4 FUNCTION UNIVERSAL REMOTES

WHOLESALE CABLE M-F 11am-6pm EST
(718) 262-0900 • FAX (718) 657-4015 • (718) 297-9221

No NY sales. Federal and local laws provide criminal and civil penalties for unauthorized use. Check with your cable providers for permission to use equipment. Must be paying for all services you receive. Order by model number only. Some equipment refurbished as new.

Tell us the best price you were offered, where you got it from, and let us try to beat it.


CELLULAR PROGRAMMERS: Handheld compact design for: MOTOROLA (95 version now available), NEC, SONY, GE/ERICSSON, AUDIOVOX, MITSUBISHI. Unique design allows activation of individual menus at any time. **ASK ABOUT OUR CONVENIENT PAYMENT PLAN!** All programmers are guaranteed. 818-425-2243 10am-6pm PST.



WHOLESALE: COMMAND Communications RD 4000 Ring decoders. With distinctive ringing service, if provided by your phone company and this unit, you can direct calls automatically to 4 separate telephone devices. Great for fax, computer, children's line or private calls. Sale price \$64.95 + \$4.50 S&H. Other phone accessories available. Fabtronics, 5714 W. Wautoma Beach, Hilton, NY 14468. 1-800-294-3228 voice, 716-392-1234 Fax.

CALLER ID & CALL ROUTING SYSTEM. Identifies caller's phone number before phone ever rings. Determines caller's priority, high, low, or reject call (hangs up on caller). 1. High priority, rings phone; if not answered call is forwarded to your answering machine. 2. Lower priority, routes caller directly to answering machine. 3. Reject, hangs up on caller without your phone ever ringing. Must have caller ID service from your local phone Co. and your own answering machine. Up to 200 phone numbers can be programmed for individual routing. Send \$125 to: JC Marketing, Suite 103, 2300 N. Clybourn, Chicago, IL 60614. Phone: 312-281-4903.

CELL PHONE vehicle mounted RF amps. Panasonic model EBP0385, to 4W out, 800-900 MHz, unused, instructions, \$30. BPB Assoc., 1977 High St., Longwood, FL 32750. 407-330-3408, Fax 407-330-3498.



WANTED

DISTRIBUTORS

FOR

NUTS & VOLTS


MAGAZINE

We'll pay a bounty for every copy you sell!

For complete information, ask for our New Distributor flyer.

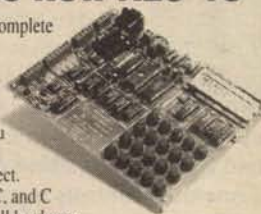
Nuts & Volts Magazine

430 Princeland Court
Corona, CA 91719
Phone 909-371-8497
Fax 909-371-3052
E-Mail:
CompuServe - 74262,3664
Internet - 74262.3664@compuserve.com



Learn MICROCONTROLLERS EMBEDDED SYSTEMS and PROGRAMMING with the New AES-10

The AES-10... a complete learning system, a complete embedded control system. Extensive manuals guide you through your 8051 development project. Assembly, BASIC, and C programmable. All hardware details, complete schematics. Learn to program the LCD, keypad, digital and analog I/Os. The entire board is software reconfigurable for your applications. Everything you need, nothing extra required.



80C32 Computer/Microcontroller board with:

- 32K Byte ROM, 32K Byte RAM • 2 by 16 Liquid Crystal Display • 4 by 5 Keypad • Two serial ports • 5 interrupt sources • 3 timers
- A/D, D/A, PWM and digital I/O • Built in Logic Probe • Power supply (can also be battery operated) • Extended Intel BASIC and AES Monitor in ROM • RS-232 cable to connect to PC for programming • 8051/52 DOS Cross Assembler • Program disks with well documented examples • User's Manual, Language Manual, and Text (over 400 pages).

AES-10 \$285

Money Back
Guarantee

Free Info Pack

M/C Visa

714 - 550-8094

Fax 714 - 550-9941

CALL

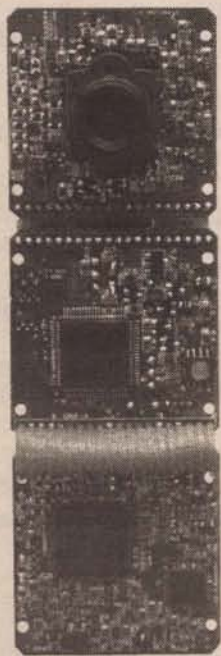
1-800-730-3232

**ADVANCED
EDUCATIONAL
SYSTEMS**

970 West 17th Street, Santa Ana, California 92706, USA

Micro-Size CCD Cameras

MB-1050C
Digital Color Camera



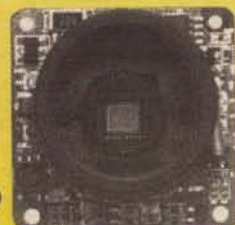
MB-750
Introductory Offer:
\$119.95

MB-750
("C" Mount & Lens Optional.)

NEW Fiber Optics: Receivers & Transmitters

- ☒ No Signal Loss to 5 miles.
- ☒ Protect from Lightning and Surges.
- ☒ Cost Effective.

- 1.25" x 1.25" Smaller Than A Credit Card.
- Color & Black/White Models.
- Models to 600 Line Res.
- 9V Battery Operation.
- Low LUX/Low Noise.
- Monitor in Total Darkness with IR Option.
- Stealth/Covert Cameras.
- Standard NTSC Output.
- Low Power Consumption.
- Can be plugged into any VCR or Monitor.
- Options: Switchers, Optics, Wireless.
- NEW Affordable Fiber Optic options for Cameras.
- 2-Way Audio Operation.



- 900 MHz For Best Picture Quality.
- Monitor In Darkness with IR LEDs.
- Monitor has Dual Channel Mode.
- Battery or AC Operation.
- Plug & Play Quick Installation.
- Mobile Security.
- Condenser Mic.
- VCR Compatible.



V-Pack 202

5 x 5.5" Receiver.

Camera Stands 4" Tall
w/o Antenna & Stand.

Wireless Monitoring Systems



Pod Stands 10" Tall
w/o Antenna.

V-Pack 101

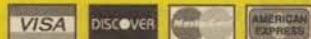
6.5" Screen
Monitor/Receiver.

Polaris Industries

Visit Polaris Ind. Home Page at:
<http://www.randomc.com/~polaris>

Prices Subject to Change Without Notice. Prices Do Not Include Shipping.

New Literature
Available for
All Models.



141 West Wieuca Road • Atlanta GA • 30342-3251 • **Order Desk: 800-752-3571** • Tech Info: 404-252-3340 • FAX: 404-252-8929

by Karl Lunt

AMATEUR ROBOTICS

I've had a lot of fun building robopets and other small machines, but they've all had a common lack; none of them included wheel encoders.

Now that hasn't actually been much of a problem. Line followers don't need wheel encoders to run simple mazes; they react to the line in front of them. Robots for the Rapid Deployment Maze don't need encoders, either; the operator controls them with a joystick.

Even Huey, my original robopet, does just fine without encoders. The subsumption architecture

struct, and it had to work with as wide a variety of motor systems as possible. Failing the last, it had to fit onto a motor or wheel system that was as widely available as possible.

As usual, the Seattle Robotics Society (SRS) provided the answer I needed. Mark Castelluccio showed off a robot some months ago, driven by hobby servo motors. His machine competed in the Dead-reckoning contest, an event that requires accurate drive systems. Since "hobby servo motors" and "accurate drive systems" don't usually go together, I was surprised when his robot took first place against some stepper-based designs.

Mark said that he had installed a home-built encoder system inside the servo motor housing itself. I really like this concept; the encoder goes where the motor goes, and you don't have to worry about special shaft adapters or drive systems.

Based solely on Mark's statement that he had installed the

new, for \$0.50 each. They also list a price for 1,000 pieces, so I figure they have a bunch on hand.

You will also need some simple tools, such as an electric drill and a 1/8" bit, some ribbon cable, some 1/16" heatshrink, and a hot glue gun.

Begin by removing the four Phillips screws on the bottom of the servo motor case, then removing the top of the case (the part that has the Futaba name embossed on it).

You need to locate and drill a hole in one side of this case top. When you are done, whichever side you use will have a blob of hot glue stuck on it, and it will have a short length of three-conductor cable coming out of it. If you intend to mount this motor on its side, take the effects of this mod into account when you choose which side of the case to drill. The mod will work with either side, but subsequent motor mounting could get tricky.

The mod requires you to mount the IR emitter/detector (E/D) inside the servo's case, so the component sits about 1/4" above one of the gears and looks down on the gear's surface. This means the placement of the hole you are about to drill is critical; you don't have a lot of room to work with inside the reassembled motor case. The hole must be placed exactly 1/4" up from the bottom edge on the top of the case (the open section that fits over the servo PCB), and exactly 3/4" from the wall next to the Futaba legend. See the accompanying hole placement guide for details.

Mark the hole's location, then clamp the case top in a bench vise or other holder. Carefully drill out the hole, then clean and deburr the inside of the case. Remove any loose plastic shavings so they don't get into the gear mechanism later.

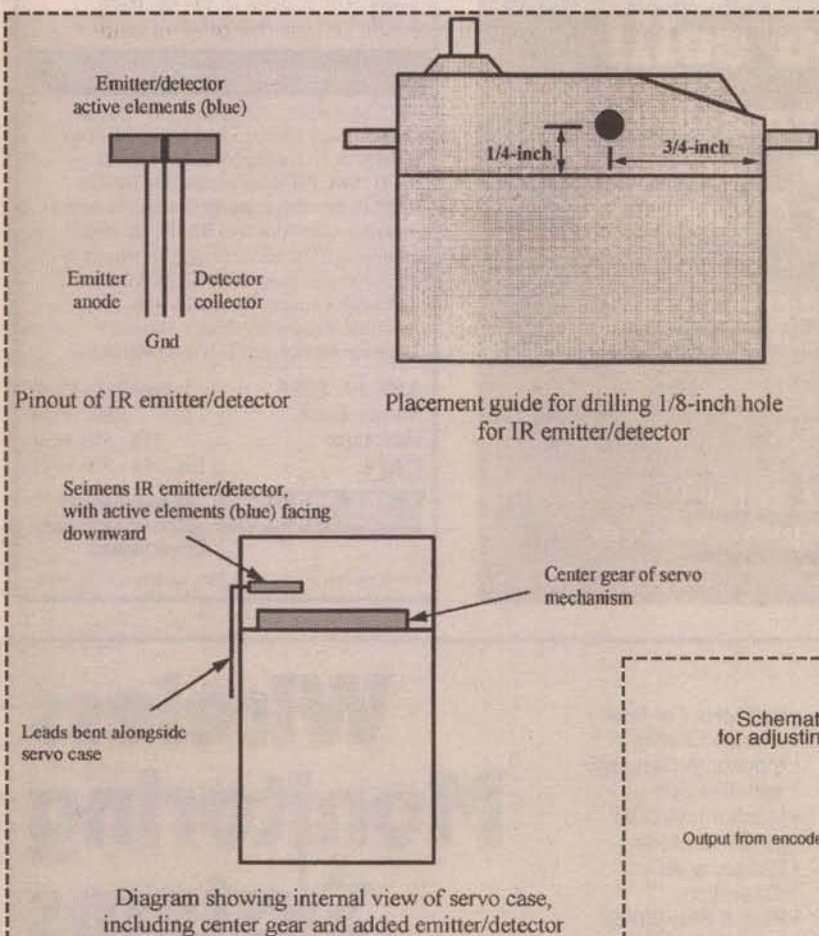
Now temporarily insert the E/D through

the hole in the case from the inside, with the leads sticking out. Make sure you have the E/D's active elements coated with a deep blue epoxy, pointed downward, toward the open part of the case top.

With the bottom edge of the E/D flush against the inner wall of the case top, carefully bend the device's leads so they fit flat against the outer wall. You should bend the leads toward the open part of the case top, so they extend beyond the edge of the

EDITOR'S NOTE: Last month, the last paragraph of the column was inadvertently cut off. Here, for your convenience, is the complete text:

The catalog sports everything from ammo boxes to parking meters, glow-in-the-dark human skulls to rubber iguanas, gearhead motors to pencil sharpeners shaped like a human nose. If the Mondo-tronics catalog is weird, the AS&S catalog is totally bizarre. Get one, you'll love it. NV



design of Huey's software means that it reacts to its environment, so path planning and navigation aren't essential. Note, however, that encoders could be added, and then Huey's code could be modified to show other behaviors.

Wheel encoders open up a whole new world of experimentation for the amateur robot builder. With encoders attached to your machine's drive system, your software can measure distance of travel, detect wheel slippage, and use dead-reckoning to make reasonable guesses as to present location.

Despite all of the advantages offered by wheel or shaft encoders, I haven't used them on a machine yet for a simple reason. I hadn't seen an encoder that I felt was suitable for designing into a robot for this column.

Sure, I've seen some real deals on the surplus market; encoders with gobs of resolution for pennies on the dollar. But if I built a machine using such a device, would the thousands of *Nuts & Volts* readers be able to duplicate my design? Probably not.

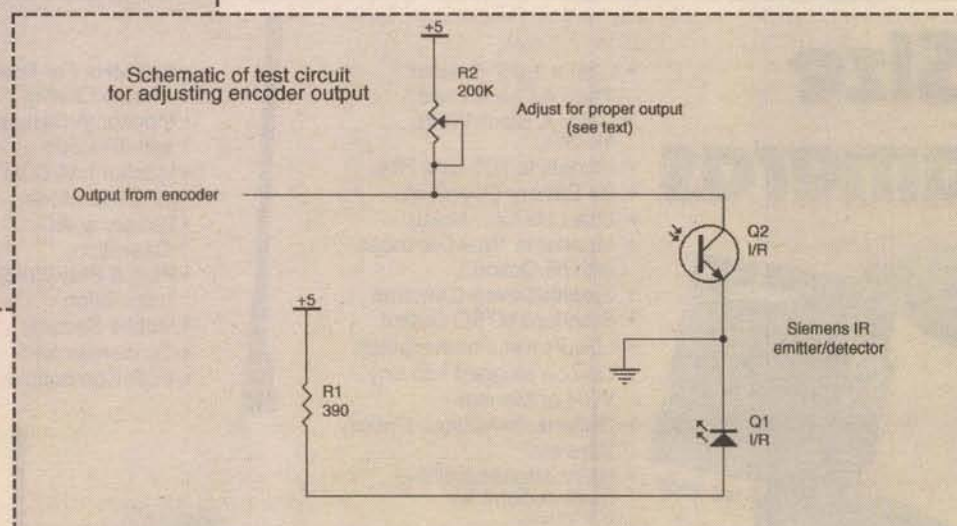
And generally, mounting an encoder on a shaft or motor requires some form of machining or special adapters. These devices would likely be unavailable to readers, as well.

So, for a long time I had to do without encoders, waiting for a design that matched some pretty tough criteria. It had to be cheap, reliable, easy to con-

encoders, but never having seen his implementation, I developed the following technique. Marvin Green, designer of the BotBoards, tackled the same problem and came up with a different solution, which I'll describe briefly. Finally, I'll give you a quick rundown on the technique Mark actually used, so you can evaluate all three and pick the one that seems the best to you.

My design fits inside the case of a Futaba S148 hobby servo, one of the more popular servos used in hobby robotics. The servo with encoder looks and works just like a servo without the encoder, except that it has an extra three-wire cable coming out of the side of the case.

The only special component you need to make this mod is a Siemens SFH-900-1 IR emitter/detector unit. Granted, most of you may not have such a device in your junk box, but they are actually quite easy to get, and very cheap, to boot. Just pick up your Electronic Goldmine catalog and look up their part number G3355. EG sells these devices, brand-



InstallServo set up a timer output channel to control a servo

Invocation: gosub InstallServo, toc
or: n = usr(InstallServo, toc)

When called as a function (USR format), InstallServo returns a 0 if the setup worked, or -1 if the toc argument was invalid.

Upon exit, the specified TOC is set to 0, effectively stopping the motor.

```
InstallServo:
select pick(0)
case TOC2      ' if this is TOC2...
push $c0      ' push the proper TCTL1 value
push $40      ' push the proper OC1D/OC1M value
endcase

case TOC3
push $30
push $20
endcase

case TOC4
push $0c
push $10
endcase

case TOC5
push $03
push $08
endcase

drop 1          ' drop invalid TOC argument!
return -1      ' report a failure
endselect

pokeb oc1d, peekb(oc1d) and (pick(0) xor $ff) ' clear bit on TOC1
pokeb oc1m, peekb(oc1m) or pull()           ' connect to TOC1
pokeb tctl1, peekb(tctl1) or pull()          ' set bit on TOC
poke pull(), 0                               ' clear TOC for now
poke toc1, 0                                 ' TOC1 hits at 0
return 0                                     ' show all went well
```

case. Tape the leads in place, using a small piece of masking tape. This should leave the E/D positioned inside the case, with the leads taped flat against the case.

Carefully put the pieces of the servo back together. You don't need to install the four screws; you are simply checking for fit and alignment. Make sure that the E/D doesn't interfere with rotation of the servo's gears in either direction. You can test this by clamping a control horn or wheel onto the motor, then gently turning the motor shaft back and forth. If necessary, reposition the E/D, using the masking tape to hold the device in place.

When you are satisfied with the alignment, separate the case top from the rest of the servo assembly. Heat up the hot glue gun, then apply a large bead of hot glue to the hole on the outer wall, filling the hole and covering no more than 1/8" of the device's leads. Remember that you still have to solder wires to the leads; make sure you leave yourself with enough length on the leads.

After the hot glue sets, put the servo back together without using the screws, and verify that the motor still turns freely. If necessary, reheat the glue and reposition the E/D.

Separate the top case again and prepare a length of three-conductor ribbon cable. You can use a piece as long as the servo motor cable, if you like. Strip 1/16" of insulation from each wire at one end of the cable, then tin the three wires. Separate the three wires for about 1", then slide a 1/4" length of heatshrink over the center wire and move the heatshrink down the wire, safely away from the bare end of the wire.

Carefully solder each wire to a pin on the E/D. Make sure you connect the center lead of the ribbon

cable to the center lead of the E/D. After the leads are soldered in place, slide the heatshrink up over the connection to the center lead, then shrink it in place using the tip of your soldering iron.

With the wiring complete, apply a blob of hot glue to the E/D's leads to complete fixing it in position. Make sure you apply glue to both the case material and the leads, and be sure to cover as much of the leads as you can. Note that you will still have bare leads protruding beyond the lower edge of the case top.

Now set aside the case top and pick up the gear assembly. Note the large center gear, sitting flat against the gear platform, positioned midway between the outer two gears.

Find a 45-degree arc section of the upper surface of this gear that is as free of gear grease as possible. If necessary, use a cotton swab dipped in rubbing alcohol to clean off a 45-degree section. Take care to remove only the smallest amount of grease necessary, and do not disturb the grease on any other gears in the assembly.

Using a black Sharpie marker, carefully fill in the cleaned 45-degree section of the gear surface. Apply one coat of ink, let it dry, then apply a second coat. When dry, this ink will serve as the encoder signal for the E/D.

Carefully rebuild the servo motor and tighten the four screws to complete the assembly. This completes installation of the servo motor encoder system.

The encoder you have just added provides 45 pulses per each wheel rotation. While this isn't up to the hundreds or thousands of pulses per rev available from commercial units, it will only set you back a buck or two. What's more, you can move this motor from one robot to another without having to deal with mounting problems beyond where to put the motor.

Next up is testing the encoder and adding some simple electronics.

Electronics

The E/D detects the darkened section on the servo gear by the amount of IR light reflected off the gear's surface. When the IR is emitted by the LED, half of the E/D falls on the white, untreated surface of the gear, and a large amount of IR reflects back to the detector. This, in turn, creates a low resistance across the phototransistor and a correspondingly low output voltage.

Conversely, the darkened section of the gear reflects much less IR. This causes the phototransistor to show a large resistance. By adding a resistor pulled up to +5 VDC, you can use the resulting voltage across the phototransistor to determine when the dark section of the gear falls underneath the E/D.

Finding the proper pull-up resistor takes a little tweaking. The resistor's value will vary from servo to servo, depending on many conditions. It is affected by the alignment and orientation of the E/D, by the density of the ink you put on the gear, and even by the type of pen you use when you mark the gear.

Fortunately, you can build a simple test circuit on a Radio Shack plug-in experimenter's board, and quickly find the best resistor value to use. Refer to the accompanying test circuit schematic for details.

Always begin your tests with a current-limiting resistor of 390 ohms. You may need to change this value later, but it will work in most cases. This is far

larger than I usually use for driving LEDs, but the reduced current is important. If you use

too much current to drive the IR emitter, you end up with IR bouncing all over the inside of the servo's case, giving you false readings.

Set the trimpot to its midrange, then apply power and monitor the voltage at the junction of the detector's collector and the trimpot. Very slowly rotate the motor's drive shaft until you get as high a reading as possible; this shouldn't require more than 90 degrees of turn.

Adjust the trimpot until you measure a voltage of at least 2.7 volts. If you get a reading above 3.0 volts, adjust the trimpot to bring the voltage down below 3.0 volts.

Now, slowly turn the motor shaft until the voltage drops dramatically. This means the darkened section of the gear has moved underneath the E/D. The voltage should be below 2 volts, ideally below 1.5 volts. If it is not, adjust the trimpot until the voltage falls below 1.5 volts.

Repeat this rotate-and-tweak operation until you read a voltage above 2.7 volts for the light portion of the gear, and below 1.5 volts for the dark portion of the gear. When you are satisfied, disconnect the trimpot and measure the resistance between the two terminals you had connected to the circuit. This value represents the optimum pull-up resistor value for that motor.

You will have to perform this same set-up with any servo to which you add an encoder. It's a good idea to mark the pull-up value for each motor somewhere on the motor's case, or on the cable coming from the motor's case. You will need this information later, when you go to hook up multiple motors in a robot.

You can now add circuitry, similar to the test circuit, to your robot computer boards. Add one set of the circuitry for each encoder you intend to use. Note that you don't have to find the exact value for the pull-up resistor, as determined by your set-up. Just use the nearest common value. For example, if your test shows a 107K resistor is optimum, you can use a 100K or 110K without any problems.

If you choose, you can also leave the trimpot in place when you add the encoder circuitry to your robot. You would need to re-adjust the trimpot if you change motors, but that would only take a few minutes, and would only need to be done once.

In some cases, you may not be able to get the above cited voltage range from your encoder. If so, you have a couple of options available. The easier option involves the darkened area of the gear. Go over the arc you marked out again, making it as black and evenly-coated as you can. In extreme cases, you might try cutting out an arc-shaped piece of black construction paper and actually gluing it to the gear's surface.

Less easy, but also worth trying, is to vary the LED current-limiting resistor. If you cannot get the encoder's output voltage to fall below 1.5 volts, try increasing the current-limiting resistor to 470 ohms. If the output voltage won't go above 2.7 volts, try decreasing the resistor to 270 ohms.

If possible, you need to use the same current-limiting resistor for all of your encoder circuitry. This will make it easier to move your encoder-equipped motors between robots.

I hook the output of the encoder circuitry to one of the three input-capture pins on the 68hc11. These are port A pins 0 through 2, though some 'hc11 variations let you configure other port A pins for this function, as well.

Software

Now that you have the electronics and mechanics taken care of, you need a little software. The accompanying listing provides an SBasic program for moving a motor a prescribed number of pulses.

As always, you can reach me at:

Karl Lunt
2133 186th Pl., S.E.
Bothell, WA 98012
E-Mail: karl@mav.com

Electronic Goldmine
P.O. Box 5408
Scottsdale, AZ 85261
(602) 451-7454

encoder.bas Program for testing encoder-equipped servo motors

This program allows the user to enter one-character commands from a serial port and control the behavior of an encoder-equipped Futaba S-148 servo motor. Available commands include speed and direction control as well as number of rotations.

This program assumes the servo motor is hooked to TOC2 and the encoder output line goes to IC1. You can change the InstallServo call below if you want to use a different TOC.

You must compile this program with SBasic11 version 1.0a or higher.

```
include "regs11.lib"      ' define the 68hc11 regs
include "servos.bas"      ' use the servo library

const DELAY = 60          ' update rate (60 * 4.2 msecs)
const PULSES = 45         ' pulses per revolution
const FWD = 1
const BKWD = 2

declare n
declare wait
declare mtr_cntr
declare target
declare running
declare fspeed
declare bspeed
declare direction

interrupt $fff0           ' RTI isr
if wait <> 0               ' if timer not yet at 0...
    wait = wait - 1       ' drop it
endif
pokeb tflg2, %01000000    ' rearm RTI
end

interrupt $ffe           ' ic1 isr
mtr_cntr = mtr_cntr + 1    ' count this pulse
pokeb tflg1, $04          ' rearm ic1
end

main:
pokeb baud, $30           ' 9600 baud
pokeb sccr2, $0c          ' turn on SCI

mtr_cntr = 0              ' init the pulse counter
pokeb tmsk1, $04          ' allow interrupts on ic1
pokeb tflg1, $04          ' clear flag for ic1
pokeb tct2, $10           ' interrupt on rising edge only

wait = 0                  ' clear the wait timer
pokeb tmsk2, peekb(tmsk2) or %01000000
pokeb tflg2, %01000000    ' start RTI system

gosub InstallServo, toc2  ' install a servo on toc2

interrupts on             ' allow interrupts

target = 0
running = 0
fspeed = $f800
bspeed = $f200
direction = FWD

print
print "encoder.bas"
print
do
    if wait = 0            ' if time to update...
        wait = DELAY      ' rearm wait timer
        printu "mtr_cntr = "; mtr_cntr; " "
        printu "target = "; target; " "
        if direction = FWD
```

```
        printx "fwd speed = "; fspeed; " "
    else
        printx "bkwd speed = "; bspeed; " "
    endif
end if
```

Check for a key from the user; if key is pressed, do the command.

You can add extra commands by inserting your own CASE statements in the large SELECT structure below.

```
n = inkey() and $ff
select n
case 'z'          ' zero the pulse counter
    mtr_cntr = 0
endcase

case 'f'          ' go forward
    poke toc2, fspeed
    direction = FWD
endcase

case 'b'          ' go backward
    poke toc2, bspeed
    direction = BKWD
endcase

case ''           ' stop the motor
    poke toc2, 0
endcase

case '+'          ' increase speed
    if direction = FWD
        fspeed = fspeed + $40
    else
        bspeed = bspeed + $40
    endif
endcase

case '-'          ' decrease speed
    if direction = FWD
        fspeed = fspeed + $40
    else
        bspeed = bspeed - $40
    endif
endcase

case '1'          ' set pulse count = n * 45
case '2'
case '3'
case '4'
case '5'
case '6'
case '7'
case '8'
case '9'
    target = (n - '0') * PULSES
    running = 1
endcase

endselect
```

This code checks the motor. If it is running, the code then tests to see if the pulse counter has hit the target. If so, this code stops the motor and resets the target value.

```
if running <> 0
    if mtr_cntr >= target
        poke toc2, 0
        running = 0
        target = 0
    endif
endif
loop
end
```

With it, you can determine how well your encoder system works. Plus, the program can serve as the starting point for developing your own encoder-based programs.

The program uses encoder interrupts on input IC1 (port A, pin 0) to increment a counter; each interrupt bumps the value in variable MTR_CNTR by one. The program also expects the servo motor to be hooked to OC2 (port A, pin 3).

This software sets up the interrupts needed to handle the servo motor and the encoder, then sits in a loop, waiting for input from the user via the serial port (SCI). You can enter several one-letter commands to control the servo motor. Additionally, the software reports vital information back, concerning servo pulse width used to control direction and speed of rotation.

For example, you can enter a single number

from 1 to 9. The software will turn the motor that number of revolutions, based on 45 counts per wheel rotation. After the prescribed number of rotations, the software will stop the motor in place.

Other commands available include a space for stopping the motor immediately, plus and minus to increase or decrease the motor's speed, 'f' and 'b' to set the direction either forward or backward, and 'z' to zero the encoder pulse counter MTR_CNTR.

While the motor is turning, the software also displays the current value of the servo timer, TOC2. This directly controls both the speed and direction of rotation. The values shown in the listing work for my motor, though you may need to tweak them for yours.

As you review this program, notice the simple code used to track encoder pulses, and how I use the information stored in MTR_CNTR to control the pro-

gram's flow. You would need to use similar code in your robot to do navigation or path-planning.

I have also included the listing for an SBasic file called SERVOS.BAS. This library file contains code for setting up interrupts needed to control servo motors. This code shows how easily you can develop powerful modules in SBasic, then reuse your code in other projects.

Other ideas

After I developed my encoder system, I got an up-close look at what Mark did to install his encoders. Basically, he had used a Dremel motor tool and a tiny saw blade to remove the plastic walls inside the servo motor case, where the servo potentiometer fit originally. In the hollowed-out space, Mark fitted a dime-sized piece of perfboard containing one IR LED, two separate IR detectors, and resistors similar to those used in my circuit.

Using two detectors gives 90 pulses per revolution, and Mark was able to align the detectors so he actually got quadrature signals from his encoders. This means his encoders cannot only determine rotational speed, but direction as well.

Also, because all of his circuitry fitted inside the case, Mark was able to steal +5 VDC from the servo electronics. Thus, he only needs three wires for his encoder system: ground and two encoder outputs. I encourage readers with the proper tools and ambition to consider Mark's mod when deciding how to add an encoder. Though his technique isn't for everyone, the added capabilities may be what your project needs.

Marvin Green developed a method midway between those used by Mark and me. Marvin also carved out the plastic walls inside the motor housing, but he installed just a single Siemens IR E/D.

The Siemens E/D units really lend themselves to this type of mod, and I'm sure many of you will be able to fit them into encoders of your own design.

You can use one of these techniques or create your own, but putting the encoder mechanics direct-

ly inside the servo case is a big win. You eliminate perhaps the biggest hurdle in optical encoders on robots — the uneven results caused by fluctuations in ambient light. Whether it's direct sunlight sneaking into the emitter, or noise from overhead fluorescents, optical encoders can prove hard to design. The dark, light-tight interior of a servo case is a perfect mounting place.

Well, that's it for this month. I'll close with a comment regarding software. I've avoided including software listings in the past, since it tends to fill up the article and I wasn't sure how much value it gave.

But I've received a lot of support for my SBasic listings, and will try to make them a regular feature in the column. Apparently, many readers enjoy actually seeing how to solve some tough programming problems, and use my examples as jumping-off points for their own designs. **NV**

WANTED

All Types of Test Equipment

WE BUY & SELL

Attn: Richard
3802 North 27th Ave., Phoenix, Arizona 85017



602-278-4062 • 602-269-1737 Fax

TELEPHONE - FAX cont.

CALLER ID DEMYSTIFIED. Understand byte-by-byte the data stream sent over the phone lines. Explains both formats currently in use, single data message format (SDMF) and multiple data message format (MDMF). Send \$10 cash, check or MO to: Kip Enterprises, 8301 Millwheel Dr., Dayton, OH 45458.



NEW FOR 1996! UL'S® EMULATOR/TEST INSTRUMENT. (REFURBISHED, DEACTIVATED, MODIFIED CELLULAR PHONE) EFFORTLESS 5 STEP, 5 MINUTE PROGRAMMING, (FOR COMMERCIAL USE). UJ'S EMULATOR SYSTEM EXTENDS MOST POPULAR MOTOROLA AMPS SOFTWARE (9122 BELOW, ETC.) TO PROGRAM FIRMWARES TO 9525, (FWs 9525 ABOVE, EE2, EE3, 80#, NOT PROGRAMMABLE.) REPAIRS 0000FFFFS. UJME-1EE EMULATOR SYSTEM OPERATES ON 12.5VDC OR 117VAC, INCLUDES PROGRAMMING HANDSET, 5 MODE EMULATOR CONTROL BOX, SOFTWARE MAMPS-1EE-G2 (AMPS 9122 BELOW, NAMPS, ETACS & G2E TO 9525 FIRMWARES), AC ADAPTER, INSTRUCTIONS AND TECHNICAL BACK-UP \$369.95. **SAVE \$98, COMBINATION OFFER: EMULATOR SYSTEM UJME-1EE WITH YOUR CHOICE, 3 OF 5 LISTED INTERFACE CABLE/HARDWARE SETS, PLUS BONUS DATA TRANSFER SWITCH BOX AND LAB TYPE REGULATED 3 AMP 12.5DC POWER SUPPLY \$674.95! INTERFACE CABLE HARDWARE SETS SEPARATELY: \$119.95 EACH.** (1) 4PCS-F/P-1EE FOR FLIP & POCKET PHONES, (2) 1PCS-UC-1EE BRICK & ULTRA CLASSIC, (3) 1PCS-B/M BAG/MOBILE, (4) 1PCS-UCII-1EE ULTRA CLASSIC II VISTA OR (5) 1PCS-E/F-1EE ELITE FLIP PHONE. S-H/COD/FEDEX/2ND DAY AIR \$24.95 PER ORDER. PAYMENT POSTAL MO OR BANK CASHIERS CHECK. 1996 CATALOG, ORDERS, ETC. TELEPHONE 702-642-0325. LESS BUSTER'S ELECTRONICS, 2039 CIVIC CENTER DRIVE #176, N. LAS VEGAS, NV 89030.

WHAT!? YOU don't have the new TELECODE 20 page 1996 CATALOG!? It's free! 520-782-2316.

PIONEER 6300 cable boxes w/remote and no E-4 modules, map switch, pretested in raw test mode, 1 yr. warranty, special \$195. P10 no E-4 PIC modules 5+ \$16 ea. P10 6300 master files with serial # conversion Win 95 ver. \$250. PIC 16C54 no E-4 program with serial # \$200. P10Writer \$75. 7 days 7am-9pm PST. 702-892-9183.

CHECK THIS Out: 100 KM cordless telephone. Works great. Save \$. Not FCC approved. Recommended for export only. Also available. Ring reader works with distinctive ring service. 954-978-8381.

FREE IBM based DTMF decoding program and schematic VIA the Internet. Send E-Mail address to PDRUNEN@AOL.COM Request by mail, send check for \$6 to Concept Technology, 8700 Turkey Bluff Rd., Navarre, FL 32566.

CELLULAR PHREAKERS. Hot new software available on one 3-1/2" disk to reprogram all parameters including ESN on all Motorola phones, except digital. Complete with all information to load into your PC. Send \$69.95 in US postal money order to Kyle Virgin with SASE. PO Box 1035, Reynoldsburg, OH 43068-7035. Or call 614-780-9081 for information.

FOR SALE 50V telephone type 16 level rotary stepper switch, collectors item. 714-494-0072.

FIVE ESN/NAM modification installed in your OKI 900 for \$250. Chip only \$150. Phone with chip \$600. Call Keith at 512-259-4770.

Serving the public since 1981

XANDI ELECTRONICS, INC.

1270 E Broadway # 113, Tempe AZ 85282

Electronic KITS!

BUY WITH CONFIDENCE

• 30-DAY REFUND POLICY
• TECH SUPPORT NUMBER
(602-894-0992)

- Miniature photo battery mounts right on circuit board. (Included with kit)
- Tunes 88-108 MHz.
- Up to 1/2 mile range.
- Sensitive 2 stage audio amplifier, picks up sounds at the level of a whisper.



- Transmits at 143 MHz.
- Up to 1/2 mile range.
- Miniature photo battery mounts right on circuit board. (Included with kit)
- Amazing audio sensitivity, picks up sounds at the level of a whisper.



- Uses sensitive microwave transistor amplifier.
- Compact hand held unit.
- Covers 1 to 2,000 MHz.
- Includes miniature loud speaker for audio indication of detected signals.



MICRO-MINIATURE FM TRANSMITTER
Including the battery, this is the Worlds smallest FM transmitter. Use with any FM broadcast receiver. Easy to assemble, uses pre-assembled circuit board.

XWB1000 E-Z KIT \$46.95

- Smallest FM transmitter anywhere!
- Tunes 88-108 MHz.
- Powerful 2 stage audio amplifier.
- Sensitive, picks up sounds at the level of a whisper.
- Up to 1 mile range.



CRYSTAL CONTROLLED TRANSMITTER
This is the Worlds smallest crystal controlled FM transmitter. Transmits to any scanner type receiver. Easy to assemble, uses pre-assembled circuit board.

XTL1000 E-Z KIT \$69.95

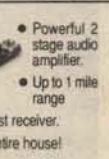
- Smallest Phone transmitter anywhere!
- Up to 1/4 mile range.
- Tunes 88-108 MHz.
- No batteries required, powered by phone line.
- Attach to phone line anywhere in house, even inside phone.



SUPER SENSITIVE BUG DETECTOR
When the XBD200 intercepts a signal in the 1 to 2,000 MHz range, it emits a growl that increases to a high pitched squeal as the signal strength increases.

XBD200 (C) Kit \$39.95

- Powerful 2 stage audio amplifier.
- Up to 1 mile range.
- Use with any FM broadcast receiver.
- Hear every sound in an entire house!



SUPER-MINIATURE FM TRANSMITTER
Worlds smallest FM transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip components are pre-assembled to the circuit board.

XST500 (E-Z) Kit \$44.95

- Digital voice changing: male to female, female to male, adult to child, child to adult.
- 16 levels of voice masking.
- Button for normal operation.
- Complete anonymity on all calls.
- Not a kit, fully assembled.

SUPER-MINIATURE PHONE TRANSMITTER
Worlds smallest FM phone transmitter. Use with any FM broadcast receiver. Easy to assemble, all chip components are pre-assembled to the circuit board.

XSP250 (E-Z) Kit \$28.95

- Digital voice changing: male to female, female to male, adult to child, child to adult.
- Use with any modular phone.
- 16 levels of voice masking.
- Connects between handset and phone.
- Not a kit, fully assembled.



MINIATURE FM TRANSMITTER
The XFM100 has a super sensitive microphone and is capable of picking up sounds at the level of a whisper and transmitting them to any FM broadcast receiver.

XFM100 (C) Kit \$21.95

- Transmits a continuous beeping tone.
- Adjustable from 88 to 108 MHz.
- Up to 1 mile range.
- Works with any FM broadcast receiver.
- Operates from battery voltages of 3 to 18 Volts.



VOICE CHANGING TELEPHONE
STOP THOSE ANNOYING TELEPHONE CALLS! Sound older and tougher when you want to. Not a kit. Fully assembled. Single phone operation only.

TRANSITION 2000 \$89.95

- Uninterrupted coverage of 800 to 950 MHz.
- Works with any scanner that can receive 400 to 550 MHz.

VOICE CHANGING ACCESSORY
STOP THOSE ANNOYING TELEPHONE CALLS! Sound older and tougher when you want to. Not a kit. Fully assembled. Use with single or multi-line phones.

TRANSITION 2001 \$59.95

- Transmit high quality stereo to any FM stereo receiver.
- Built in output level monitor for quick and easy tuning.
- Ideal for use with personal CD player.



TRACKING TRANSMITTER
Measuring 0.7 by 2.4 inches, the XTR100 is ideal for use in locating lost model rockets, bicycles, automobiles, games of hide and seek, and contests.

XTR100 (C) Kit \$29.95

- Dial your phone from anywhere and listen to the sounds inside your home.
- Two digit Touch Tone code for secure operation.



800-950 MHz SCANNER CONVERTER
If your scanner can receive 400-550 MHz, just add the XLC900 for uninterrupted 800-950 MHz coverage. It converts all 800-950 MHz signals down to 400-550 MHz so your scanner can receive them! Add our custom case and knob kit for that "Professional" look.

XLC900 KIT \$49.95

XLC-MATCHING CASE SET \$13.95

FM STEREO TRANSMITTER
Transmit full bodied Hi Fi stereo to any FM stereo receiver. Separate left and right inputs and gain controls. Includes an output booster stage for greater range.

XFS108 KIT \$39.95

XFS-MATCHING CASE SET \$13.95

TELEPHONE SNOOP
The latest in home or office security. Dial home from any other telephone, enter a two digit security code, and listen to all the sounds in your home. Automatically turns on without ringing the bell, waits for code, then remains activated for one and a half minutes.

XPS1000 KIT \$55.95

XPS-MATCHING CASE SET \$13.95

WE ACCEPT VISA, MC, MO, COD



TOLL FREE ORDER LINE: 1-800-336-7389

FAX LINE: 1-602-731-4748

ASK FOR FREE CATALOG OF OUR PRODUCTS

SEND MAIL ORDERS TO:
XANDI ELECTRONICS
BOX 25647
TEMPE, AZ 85285-5647

Write in 198 on Reader Service Card.

Check out these prices before you place your next order!**
Capacitors, Resistors, Diodes and Much More

1/4W 5% Carbon film \$3.15/K, 1/4W 1% Metal film \$5.85/K

.01µf +-20% Z5U 50V Ceramic Disc with .250 lead spacing \$15.00/K

1µf 20% 50V Radial electrolytic 5x11mm \$23.00/K

1N4001 - 1N4007 1AMP Diodes \$10.50/K, 1N4148 Switching Diodes \$8.50/K

2N3904 Transistor \$33.00/K

****Some restrictions apply. Call for details**

We also have many close out specials, call or write for a free catalog.

In our current close out special, we are offering Information Storage Devices (ISD) #ISD-VM1110A, 10 Second Voice Module, regularly priced at \$7.00 each, now only \$5.00 each while quantities last. We also have, Speakers, Audio Pots, Microphones, Adapters, and much more!!

Visa and Master Card Accepted. Toll Free 1-800-323-8962 (c/o Edmar)

Please, it is important that you ask for M.O.O. sales, ask for Lynn, Nicole or Larry, thanks.

The M.O.O. Corp. 809 W. Estes Schaumburg, Illinois 60193

CABLE TV BLOW- OUT

MicroCom Industries Inc.
800-665-2002

Call for FREE Brochure

- Quantity Orders Only
- All Other Models Available
- Call for Pricing of Smaller Quantities

**Best Dealer Prices
Available Anywhere**

MasterCard • VISA • AMX • COD

Scientific Atlanta and Pioneer are registered trademarks and all references are for identification purposes only.

“The Originals”

TvT - 3G

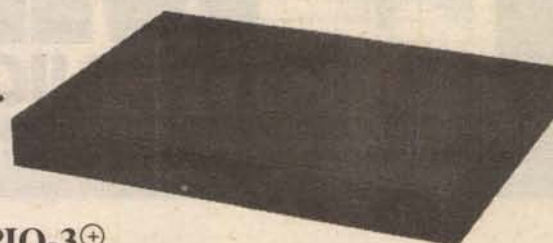
TNT - “DIGITAL DYNAMITE”
Activates all except Baseband.

SCIENTIFIC ATLANTA® M80
Activates all Sci. Atl. except Baseband.

NEW IMPROVED!!!

PIONEER® PIO-3⁺
This is NOT the Pioneer Green! This PIO-3⁺ always works, even when the “Green” doesn’t!!

MicroCom still offers these add-on descramblers and the **BEST** dealer prices available anywhere!



550 Mz BASIC CONVERTERS:

MILLENNIUM³

PANASONIC TZPC 145 CONVERTER

SA 8511-300 CONVERTER

VISION³ CONVERTER

Comes with wireless remote control.

Options include: parental control (except 8511), last channel recall, favorite channel memory, sleep timer, and many more. Channel 2 or 3 available also.

**All other models available.
Call about our specials on
the Zenith ST1600.**

NEW!!!

NOVAVISION

Revolutionary new universal one-piece converter and descrambler. Fully activates all Scientific Atlanta, Pioneer systems, and others except Baseband. Options include:

- Picture in Picture
- Simultaneous watch/record
- Clock/sleep timer
- Volume/Mute
- Parental control
- On-screen display
- Stereo
- Last channel recall
- Favorite channel memory
- Ch 3/4 switch



NEW!!!

MILLENNIUM³⁺

The Millennium³ with built-in TvT, TNT, M80, or PIO III for a complete one-piece converter and descrambler. Fully activates all Scientific Atlanta, Pioneer systems, and others except Baseband. Options include:

- Picture in Picture
- Simultaneous watch/record
- Std/HRC switch
- Parental control
- Remote A/B switch
- Last channel recall
- Favorite channel memory
- Ch 3/4 switch

**Call for Pricing on
Novavision and Millennium³⁺**



BUY • SELL • CONSIGN

WANTED

- Electronic Test Equipment
- Electronics Inventory
- Scientific Equipment
- Mfg. Shop Equip.
- Data/Telco
- Memory

DEXIS

9749 Hamilton Road
Eden Prairie, MN 55344

We Sell
Nationally!
Call our Fax-On-
Demand System, or our
Internet site for current availability.
Visit our 25,000 sq. ft. showroom warehouse
M-F 9 to 6; Sat 9 to 5

PHONE: (612) 944-7670

INTERNET: WWW.GO2DEXIS.COM

FAX: (612)942-9712 • FAX-ON-DEMAND: 1-800-547-4636 X 300

Write in 159 on Reader Service Card.

TELEPHONE - FAX cont.

GSM AND NMT-450 CELLULAR PHONE CLONING information wanted for Europe & Far East. Also looking for datastream decoders and SAK reprogramming means. Cash is waiting. Write to: PO Box 13, 117313, Moscow, Russia. Tel: 7-095-247 8147. FAX: 7-095-336 0355. E-Mail: decode@dol.ru



\$49-\$139. MOTOROLA CELLULAR PHONES, REFURBISHED, COMPLETE SET INCLUDES ANTENNA, BATTERY LEATHER CASE & AC BATTERY CHARGER. Guaranteed, ready for activation! (1) **BRICK PHONE 8000 SERIES, 8 FUNCTION KEYPAD (Thick model)** \$49.95, firmware below 9122. (2) **BRICK PHONE, 9 FUNCTION KEYPAD \$49.95**, firmware 9122-9340. (3) **ULTRA CLASSIC I (Thin model)** 9 FUNCTION KEYPAD \$59.95, WITH NAME MEMO, & MC2 COMPATIBLE \$69.95, firmwares 9122-9340. (4) **ULTRA CLASSIC II-VISTA (Thin models)** 9 FUNCTION KEYPAD PLUS 3 HOT DIAL KEYS, MC2 COMPATIBLE \$79.95, firmware 9342-9525. (5) **ATTACHE SERIES IV, 3 WATT CAR PHONE, low profile, plugs into car cigarette lighter jack \$79.95**, with integral battery and AC charger \$99.95. Firmware 9360. (6) **MICRO-TAC FLIP PHONES, 9 FUNCTION KEYPAD \$129.95**, MC2 COMPATIBLE \$139.95. Firmware 9122-9340. **NOTE: PHONES OFFERED, utilize 66#-69# test commands and not post (2-25-95 FCC ruling) test commands VIZ: 80X# SERIES EE2-EE3 WITH FIRMWARES ABOVE 9524. S-H/COD/FED-EX/2ND DAY AIR ADD \$12.95. PAYMENT MO OR CASHIERS CHECK. TELEPHONE OR MAIL ORDERS ONLY. CALL 702-642-3558. LESS BUSTER'S ELECTRONICS, 2039 CIVIC CENTER DRIVE #176C, N. LAS VEGAS, NV 89030.**

CELLULAR PROGRAMMERS: Handheld compact design for: MOTOROLA (95 version now available), NEC, SONY, GE/ERICSSON, AUDIOVOX, MITSUBISHI. Unique design allows activation of individual menus at any time. **ASK ABOUT OUR CONVENIENT PAYMENT PLAN!** All programmers are guaranteed. 818-425-2243 10am-6pm PST.

CELLULAR ANALYZER: "LIKE A DDI IN THE PALM OF YOUR HAND." The Extension Service Pro "ESP" cellular analyzer is the smallest & most advanced unit on the market. Decodes reverse control channel data, tracks cellular calls, decodes DTMF, decodes digital data, programs cellular phones (optional), and much more all in one ultra-compact design. Call 714-647-7236 for detailed info. by fax. 818-425-2243 for orders 10am-6pm PST.

PAGER OWNERS! Use your pager as a security monitor to monitor your burglar alarm and telephone answering machine using **Pageout** automatic paging system. Save money. Sells for \$99.99. Volume purchasing \$69.99. Call 410-483-6211.

PHONE SYSTEMS WANTED!!! We buy AT&T MERLIN, SYSTEM 25/75/85 and other AT&T phone systems. Please call for a quote or fax us your equipment list. **KEYWAYS, INC.**, 513-847-2300 or FAX 513-847-2350.

NORTHERN TELECOMM #2960 telephone network interfaces (RID/MTU). \$3.25 each singles, \$2.45 tens, \$1.70 hundreds. Full docs available. **SYNERGETICS SURPLUS**, Box 809, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

CELLULAR TELEPHONE. Reprogram from your computer, Motorola bag changed in minutes. Compare, ours is at a much lower cost. Software & manual \$199. Voice or FAX 903-389-8352. Call now. MC/VISA, COD. Loader phone kits, \$150.



\$149-\$259 EXTENSION CELLULAR PHONES. MOTOROLA, REFURBISHED WITH ACCESSORIES, IDEAL FOR BACK-UP EMERGENCY USE. PHONE IS ACTIVATED TO ACT AS EXTENSION PHONE OF YOUR PRESENT CONTRACTED TELEPHONE NUMBER (NAM AND YOUR PERSONAL ESN NUMBER). PHONES INCLUDE ACTIVATION TO EXTENSION, BATTERY, LEATHER CARRY CASE AND AC BATTERY CHARGER. MODEL 8000 BRICK PHONE \$139, ULTRA CLASSIC SLIM LINE \$159, ULTRA CLASSIC II (VISTA MC2 WITH 3 PRIORITY DIAL KEYS) \$179, MOTOROLA FLIP \$199, FLIP WITH MC2 \$229 AND FLIP MC2 LITE \$259. ATTACHE C/C, SERIES III-IV, 3 WATT CAR PHONE, LOW PROFILE PLUGS INTO CAR CIGARETTE LIGHTER JACK \$179, WITH INTEGRAL BATTERY AND AC CHARGER \$199. 90-DAY DEFECTIVE EXCHANGE, EXCEPT BATTERY. TO ORDER: ACTIVATED-EXTENSION CELLULAR PHONE REQUIRES MAILED OR FAXED COPY OF YOUR CELLULAR CARRIERS ACTIVATION SERVICE CONTRACT. TELEPHONE-FAX 702-642-3558. S & H CHARGES FEDEX AIR \$14.95 PER ORDER, POSTAL MO OR CASHIERS CHECK ONLY. SORRY NO NEVADA SALES. TELEPHONE-FAX-MAIL ORDERS ONLY. LESS BUSTER'S ELECTRONICS, 2039 CIVIC CENTER DRIVE #176C, N. LAS VEGAS, NV 89030.

USED CELLULAR PHONES: OKI 900 with two batteries, carry case, charger and car adapter, A++ condition: \$199, Motorola 8000 with two batteries, case and charger \$99, Diamondtel 92 T with car cord \$99. Others available, quantity discounts. Call CGC 714-581-2121.

TOP SECRET

CONSUMERTRONICS
2011 Crescent, P.O. Drawer 537
Alamogordo, NM 88310

Please order by Mail or Fax only

Fax: (505)434-0234

439-1776 (orders only; If you get voice, enter #11 any time), 24-hr

Customer Service & Tech Support: (505)439-8551

(8AM-6PM MST, Mon-Sat). Relates directly to your order or prospective order.

Web Page: Visit our popular home page and tell your friends: <http://users.aol.com/wizguru/hl-tech.html>

10% Off on orders \$100+

15% Off on orders \$200+

Add \$5 total S/H (US, Canada). All items in stock. Postal M.O. is fastest. VISA, MC

CC OK. COD (\$49-\$999), add \$8. New Catalog (200+ offers) \$2 w/order, \$5 w/

(no CC), \$24 foreign. NO dealers. Sold for educational purposes only.

Since 1971. As seen on CBS "60 Minutes,"

Forbes, etc. By John Williams - former Lockheed Senior Engineer, NMSU CS

Professor, DOD Electronic Weapons Engineer, NIH Health Physicist.

Wanted: 5 MAC Irix, PC486 (or better), peripherals, new surplus electronic parts, test equipment - buy, trade.

*All software supports all IBM-PCs

Off-The-Shelf HARDWARE

Van Eck Systems>Data Card Reader/Writers*ATM3*RF/EM

Wave/Radar/Ultrasonic/IR/Light/Sound Detectors/Receivers/Xmit-

ters/Jammers/Blasters*Security/Surveillance*EM Lab/Weaponry/

Countermeasures*Neurophone/Rife/Hieronymus/Resonant Cryst-

tal Radionics*Voice Disguisers*ESS Infinity Devices*Phone

Color Boxes*DTMF Decoders*Bug/Tap Detector/Blasters*Line-

man's Handsets*Bumper Beepers/Child Finder*Panic Button*

Carjack/Kidnap Foiler*Hidden Presence Detectors*Subliminal

Mixer/Amp*Hearing Assistant/Shriek Module*TENS*Electron-

ic Dowser*Vortex Generator*6th Sense Communicator*Noise

Cancel System*Laser*Levita-tor - more! See New Catalog!

SPECIAL PROJECTS

We design/build/modify/obtain/repair/maintain/consult on any

device/system/process/project electronic/computer/mechanical/optical (ex: phone/auto/se-

curity/radionic/lab/energy/HV/EM/RF/radar/ultrasonic/IR/UV/

commo/consumer) for business/personal/invention needs. Describe & Include \$30 pre-

engineering fee (no obligation). Time & cost estimates 7-10

days. Confidentiality guaranteed.

1+ GBYTE DATABASE

Let us search our massive 1.03 GigaByte Hi-Tech Survival Database

for you. Virtually every major Hi-Tech Survival topic covered in depth. Some

private files. See New Catalog.

AUTOMATIC TELLER MACHINES

ATM crimes, abuses, vulnerabilities and defeats exposed! 100+ methods de-

tailed, include: Physical, Reg. E, cipher, PIN compromise, card counterfeiting,

magnetic stripe, false front, TEMPEST, Van Eck, tapping, spoofing, inside job, super-

cool, vibration, pulse, high voltage - others. Case histories, law, countermeasures, detailed security checklist, labeled

internal photos, figures. ATMs contain up to \$250,000 in cash! Recent \$350,000

ATM crime spree still unsolved! \$39.

CREDIT CARD SCAMS

Cardholders, merchants, banks suffer \$ Billions in losses annually because of

credit card fraud. Describes every known means of credit card fraud and scams. Protect yourself! \$29.

ULTIMATE SUCCESS MANUAL

Underpaid, overworked, harassed or abused? Victim of office politics? Stuck in a dead-end job? Can't find a good job? Expect to be laid off, fired or transferred soon? The ultimate no-holds-barred, look-

ing-after-#1 Machiavellian techniques to find, obtain, optimize and keep top jobs, pay and benefits. THE RULES OF THE GAME FOR A GAME WITHOUT RULES! From resume to CEO. \$29.

THE HACKER FILES

Compilation of 100s of the best articles written (in ASCII) by top hackers & phreakers. Covers every major topic in

hackerdom! 3 HD Disks* \$59.

ROCKET'S RED GLARE

Design and construction of solid-propellant amateur and survival rockets. Emphasis on

formulation, manufacture, installation of propellants, motors, igniters, etc. Includes

list of commonly available materials, and the design of launch pads and test beds

(with schematics) \$29. **FIREWORKS:**

How firecrackers (M-80s, blockbusters, cherry bombs), small rockets, volcanos,

fountains, sparklers and safety fuses are made and colored. Simple, cheap, common

ingredients. \$9. Both \$36.

Please Order Today!

CELLULAR/CORDLESS PHREAKING

How cellphones operate and are modified. Vulnerabilities to hack attack and countermeasures. Comprehensive info on re-

programming NAMS, ESNs, etc (cloning), control data formats, computing encoded

MINs, ESNs, SIDHs, operating systems, PROMs and their programming, forcing

ACK, test mode and resets, scanning, tracking, scanner restorations, freq and

channel allocations, roaming, ESN and SIDH tables, parts/equipment sources, at-

tendant stations, non-USA bands, health concerns, and the EGPA and critique.

Step-by-step descriptions to keypad-re-

program 100+ popular cellphones. Plus complete section on phreaking cordless

phones! Much more. Comprehensive, invaluable - 10 times more info than our

competitor's \$79 manual! \$69. (Do Special Projects (above) for all your

cellphone hardware/software needs).

Free Data Search: As a special FREE

service to our C&CP customers, we will perform one FREE search of our massive cellphone

database if requested within 30 days of your purchase of C&CP. Data now on cellphones is so

great, we can fit in C&CP only that in greatest demand. Search results not guaranteed. Request by mail (don't fax), include a #10 SASE.

PBX HACKING

1000s of PBXs are hacked to the tune of about \$8 Billion/yr! While our "VOICE MAIL

HACKING" (below) details how VMSs are hacked for "phun" and profit - including

VMS methods for hacking PBXs themselves - "PBX HACKING" addresses all other

issues relating to PBX hacking, including countermeasures. Can your business or

agency afford a \$90,000 phone fraud loss (average loss due to hacked PBXs)? As de-

scribed in Forbes Magazine article, \$29.

VOICE MAIL HACKING

How Voice Mail Box (VMB) systems are used and the specific ways they are

hacked. Includes ASPEN, MESSAGE CENTER, BIX, GENESIS, RSVP, CENTAGRAM, EZ,

AUDIX, SYDNEY, PHONE MAIL, CINDY, SPERRY LINK, etc. An absolute must for all

users, sysops and security personnel! \$29.

HACKING ANSWERING MACHINES

How answering machines are hacked to listen to - even erase - messages, and to

convert them into mini-VMBs. And countermeasures - protect yourself from snoops,

stalkers, burglars and pranksters! \$29.

PHREAKING CALLER ID & ANI

Details on how they work and dozens of effective ways of defeating Caller ID, ANI,

'69, '57, Call Blocking and '67. Also describes Caller ID, Orange, Beige, Cheese

and CF Boxes, ESS, SS7, E-911, various CLASS services, CNA, NON PUB DA,

CAMA, DNR, 800-ECR, Diversers, LD Ex-

tenders, Centrex - more. \$29.

Beyond PHONE COLOR BOXES

Dozen phone color boxes described - many circuits. Plus Call Forwarding, Conferenc-

ing, Phreak History, Glossary, Diversers, Extenders, Loops, REMOBS, Bridging

Heads & Cans, Optocom, 3rd Party and many other non-box methods - more. \$39.

COMPUTER PHREAKING

Describes in detail how computers penetrate each other, and how VIRUSES, TRO-

JAN HORSES, WORMS, etc are implemented. Dozens of computer crime and

abuse methods and countermeasures. Includes disk filled with hacker text files and

utilities, and the legendary FLUSHOT+ protection system (Ed. Choice, PC Magazine).

BBS advice, password defeats, glossary - much more! Manual & Disks* \$39.

Beyond VAN ECK PHREAKING

eavesdropping on TV and computer video signals using an ordinary TV described in

detail. Includes security industry reports. Range up to 1 KM. Plans include both the

Consumertronics and the original Top Secret Van Eck designs! \$29.

CONS, SCAMS & RELATED SWINDLES

Cons, scams and related swindles fleece Americans of \$100+ Billion per year! The

most comprehensive survival manual on cons & scams of all kinds - from the classic

to hi-tech. Details 100s, their many variations, and countermeasures. Protect

yourself! \$39.

THE HACKER FILES

Compilation of 100s of the best articles written (in ASCII) by top hackers & phreakers. Covers every major topic in

hackerdom! 3 HD Disks* \$59.

ROCKET'S RED GLARE

Design and construction of solid-propellant amateur and survival rockets. Emphasis on

formulation, manufacture, installation of propellants, motors, igniters, etc. Includes

list of commonly available materials, and the design of launch pads and test beds

(with schematics) \$29. **FIREWORKS:**

How firecrackers (M-80s, blockbusters, cherry bombs), small rockets, volcanos,

fountains, sparklers and safety fuses are made and colored. Simple, cheap, common

ingredients. \$9. Both \$36.

Please Order Today!

STOPPING POWER METERS

As reported on "60 MINUTES": How certain devices can slow down (even stop)

watthour meters - while loads draw full power! Device plugs into one outlet and

normal loads into other outlets. Also describes meter creep, overload droop, etc.

Plans \$29. **THE I.Q. MANUAL:** External magnetic ways (applied to meter itself) to slow down and stop watthour

meters while drawing full loads. Plans. \$25.

KW-HR METERS: How watthour meters work, calibration, error modes

(many), ANSI Standards, etc. Demand and Polyphase Meters. Other experimental

results to slow and stop meters by others. \$25. Any 2, \$47. All 3, \$69.

UNDER ATTACK!

Electromagnetic Interference and Electronic Weapon Attacks cause: Cancer,

birth defects, and profound psychological, neurological, cardiovascular and immune

system disorders! Destructive to people, animals, plants, equipment! Includes

ACTUAL CASES OF EM ATTACKS (we investigated) Includes how to verify and pinpoint

EMI and electronic attack sources, and specific countermeasures. \$29. **EM**

BRAINBLASTER: Tutorial and plans for powerful ELECTROMAGNETIC WEAP-

ONS AND LAB DEVICES. Optimum circuits, freqs, waveforms, duty cycles, intensities.

Thorough, \$29. Both \$49.

MIND CONTROL

Concern and fear increases over EM and ultrasonic mind (and body) control technologies - especially implants! Unfortunately,

there is much more misinformation and disinformation published than facts. Some

victims are controlled and exploited by arm-chair "experts" and so-called victims' assistance groups - one even

demands the policing of the Internet to prevent and remove postings it doesn't

approve of! \$39. Visit our web page at: <http://users.aol.com/wizguru/mindcontrol.html>

RADIONICS MANUAL

Exciting electrical, electronic and electromagnetic therapeutic, diagnostic and

preventive devices (mostly experimental). History, descriptions, plans (dozens), avail-

abilities of Radionics Devices from early to modern. While drugs cost \$ Hundreds,

electricity costs pennies! \$29. **HEAL**

THYSELF: Plans for 3 major electronic therapeutic devices of types approved by

FDA. \$24. **EMF & LIGHT THERAPIES:** Systematic study of the germicidal

properties of EMFs and lights *in vitro* and *in vivo*. Bands include μ waves, 4 IR, 6 visible

and 3 UV, using continuous, single-pulse, strobe, random pulse rate and width

exposures. \$29. Any 2, \$49. All 3, \$69.

HIGH VOLTAGE DEVICES

HV device plans: Stun Gun, Taser, Prod, Cane, Flasher, Blaster, Zapper, Audio/

RF/Radar Jammer, Jacob's Ladder, Plasma & Van de Graaff Gens., Fence

Charger, Gelger Counter, Ozone Gen., Fish Stunner, Plant Slim., Kirlian, more!

All plans for only \$29.

STEALTH TECHNOLOGY

Police radar is fascinating! It also has error rates of 10-20%! Every known error</

PRIME ELECTRONIC COMPONENTS, INC.

150 West Industry Court, Deer Park, NY 11729

CHECK OUT OUR WEB SITE @ www.imsworld.com/prime/

516-254-0101

FAX 516-242-8995



EPROM & CPU/MPUs SOCKET PULLS

Math-Coprocessor & CPU	
8087-1	\$19.95
80287XL	\$19.95
80386DX-16	\$4.95
80387SX-16	\$14.95
80387SX-20	\$17.95
80387SX-25	\$19.95
80387DX-20	\$17.95
80387DX-25	\$24.95
80486SX-25 (PGA)	\$14.95
AM486DX-33 (PGA)	\$17.95
80486DX-50 (PGA)	\$19.95
All parts, all socket pulls must be cleaned & erased. *Note: Speed selection available at additional charge and all parts subject to availability.	

EPROMS	
2516	\$0.65
2716	\$0.65
2732	\$0.75
2764	\$0.95
2764A	\$0.95
27C64	\$1.25
27128	\$1.45
27128A	\$1.45
27256	\$1.90
27C256	\$2.25
27512	\$2.45
27C512	\$2.65
27C010	\$4.95
27C100	\$4.95
27C1001	\$6.50
27C1024	\$3.95
27C020	\$5.95

All DRAMS are clean socket pulls and have full leads.	
4164-15	\$0.18 Ea.
4164-12	\$0.25 Ea.
41256-15	\$1.00 Ea.
41256-12	\$1.25 Ea.
41256-10	\$1.35 Ea.

NEW 8 MEG 70NS 72 PIN SIMM MODULES

New 2MX32-70 (double sided, 16 chip) SIMM memory module. Perfect for upgrading current machines for Windows 95. 30-day guarantee. (Mixed manufacturers) 2X32-70 (8 Meg SIMM)\$219.95 Ea.

NEW 170 MEG 2.5" IDE HARD DISK DRIVE

Laptop replacement or up-grade 2.5" hard drive. Logical Translation 989 Cyl./10 heads/34 Sec. Check your BIOS. 15ms +5Vdc 0.5 Amp. (P/N 84G1745). IBM-H2172-A2/(84G1745).....\$109.95 Ea.

NEW MATSUSHITA 4X CD-ROM DRIVE (CR-504-B SCSI INTERFACE)

New four speed CD-ROM drive with motorized tray. (Caddy less design) Interface: SCSI 5-1/4" half height. Face plate color: Cream. Supported directly by OS/2, Windows 95, Windows NT. Note: No software included. CR-504-B 4X CD-ROM MAT\$129.95 Ea.

USED 150 MEG SCSI TAPE BACK-UP

Pulled from working equipment 150 meg SCSI Wangtek P/N 5150 ES. 30 day guarantee. 5-1/4" half height off-white color face plate. Interface: SCSI/150 pin. WANGTEK 5150ES\$89.95 Ea.

NEW AST 1000VA MANHATTAN UPS

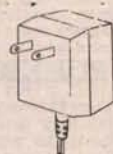
1000VA uninterruptible power system made by AST. Great protecting your system and data. 120VAC input voltage/117VAC output voltage. 50/60 Hz sine wave output <3% distortion. Microprocessor controlled with RS-232 serial interface. Power management software included on CD-ROM. Note: Shipping weight 47 lbs. AST Manhattan 1000\$179.95 Ea.

NEW MICROSOFT TWO-BUTTON PS/2 MOUSE

The old-style type, but old reliable. Note: No software included with mouse. MS PS/2 Mouse\$19.95 Ea.

WALL PLUG WALL ADAPTERS

Input: 117 Vac 50/60 Hz. Outputs Available.



Quantity
Pricing
Available

6Vdc 400Ma	\$2.00 Ea.
9Vdc 200Ma	\$1.50 Ea.
9Vdc 300Ma	\$2.50 Ea.
9Vdc 450Ma	\$3.50 Ea.
9Vdc 500Ma	\$2.95 Ea.
9.5Vdc 750Ma	\$3.50 Ea.
12Vdc 100Ma	\$1.25 Ea.
12Vdc 200Ma	\$1.50 Ea.
12Vdc 500Ma	\$2.95 Ea.
12Vdc 600Ma	\$3.95 Ea.
12Vdc 800Ma	\$6.95 Ea.
12Vdc 830Ma	\$4.95 Ea.
14Vdc 500Ma	\$3.50 Ea.
14Vdc 700Ma	\$5.95 Ea.
16Vdc 1.2Amp	\$6.95 Ea.

NEW 80486SX-25 BABY MOTHERBOARDS

Supports up to 32MB of RAM on-board. 256KX9/1MegX9/4MegX9/(80NS) 30 Pin type SIMM. Five 16 Bit Slots and One 8 Bit Slot. AMI BIOS/Supports loadable hard drive parameters 720K/1.2Meg/1.44Meg/2.88Meg (with proper controller) 8K internal cache only. 486SX-25 Baby Motherboard (CPU included) P/N 486SX25MB\$59.95 Ea.

NEW NISCAN/GS PLUS OCR/256 GRAY SCALE SCANNER

Brand New True 256 Gray Scale Hand Scanner. Resolution: 25-400 DPI. Scan Width: 4.2 In. Scan Length: 11 In. Interface: 16 Bit high speed (ISA) card. 64K SRAM. System Requirements: 286/386/486 PC Compatible (16MHz). Available 16-Bit Interface slot. Windows 3.1, 4 Meg RAM, 10 Meg of Available HD space (Min.). Mouse or Other pointing device.



Software Included: Picture Publisher LE 3.1. (Imaging Software), Perceive Personal 2.1. (OCR Software) Niscan/GS Plus\$49.95 Ea.

USED 1.44 MEG FLOPPY DISK DRIVE

Pulled from working equipment 1.44 Meg. 3.5" In 5-1/4" mounting bracket. 30 day guarantee. 5-1/4" half height off-white color face plate. Interface: 34 pin & 4 pin power. Sony MP-F17W-70D\$19.95 Ea.

NEW AST 101 ENHANCED KEYBOARD

Brand new AST 101 keyboards with 4 ft. coil cord to 5 pin male DIN. At compatible only. Available in black or off-white. AST 101 KB (black or 0/white)\$24.95 Ea.

NEW OEM/DEC ATI VGA WONDER 512K ISA VGA VIDEO BOARD w/BUS MOUSE

This board was made for DEC's line of PCs by ATI. It is the ATI wonder ISA bus with three button mouse included. (Plugs into the back of the video board.) 640x480/256 color: 800x600: 1024 x 768/16C. Note: Software included with board and bus mouse. OEM/DEC ATI PS1XG-AA\$39.95 Ea.

NEW CYRIX FASMATH COPROCESSOR CX-83D87-33-GP

New Cyrix FasMath coprocessors for 80386DX16-33 systems. This FPU unit is used in place of Intel's 80387DX16-33 part. Originally priced at \$100.00, a steal \$10.95. Case: 68 pin grid array. Cyrix CX-83D87-33-GP\$10.95 Ea.

USED 80 MEG 3.5" SCSI HARD DISK DRIVE

Pulled from working equipment. 80 Meg SCSI Quantum P/N ProDrive 80S. 30-day guarantee. 3-1/2", 1/3 Height (1-5/8"). Interface: SCSI/2, 50 pin. Quantum 80S SCSI\$49.95 Ea.

NEW SQUARE EQUIPMENT FANS

115 Vac 3.1" or 4.7"	\$7.95 Ea.
12 Vdc 3.1" or 4.7"	\$6.00 Ea.
12 Vdc 2-3/8"	\$4.95 Ea.
12 Vdc 2-5/8"	\$6.00 Ea.



NEW PANASONIC 360K 5-1/4" FLOPPY DRIVE

5-1/4" half height Panasonic M# JU-455. Black face plates only. P/N: JU-455\$9.95 Ea.

NEW PORTABLE 14.4 FAX/DATA MODEM WORLDPORT BY USROBOTICS

Brand new portable 14.4 V.42bis Fax/Data Modem. Attaches directly to portable or desktop computer. (Standard DB9S on Cable end.) Battery powered 9V or with wall adapter included. Includes integrated Fax/Communications software for Windows and DOS. WorldPort 14.4 USR\$79.95 Ea.

NEW 200W BABY SWITCHING POWER SUPPLY

Input: 120V-220V, 50Hz/60Hz, UL & CSA. Output: +12 Vdc @ 8 Amp, +5 Vdc @ 22 Amp -5 Vdc @ 0.5 Amp, -12 Vdc @ 0.5 Amp Model #SA201-3440 Astec\$24.95 Ea.

NEW AA HIGH CAPACITY NI-CAD BATTERY

1.2Vdc 800Ma/Hr. Charge Rate 15 Hours @ 80Ma. Manufacturer Kenwood/Batteries have nipped end. Kenwood NB-88 (KR-AA)\$1.75 Ea. Kenwood NB-88 (KR-AA) 4 or more\$1.50 Ea.

NEW MITSUBISHI 1.2 MEG 5-1/4" FLOPPY DRIVE

5-1/4" Half Height Mitsumi. Model #MF504C-318MD. Tan face plate only. Mitsubishi 1.2M FDrive\$24.95 Ea.

USED ADAPTEC 1540A ISA SCSI-2 CARDS

Pulled from working equipment. The Adaptec's first generation 1540A SCSI-2 ISA BUS card. Includes 2 Device 50 Pin SCSI cable. (NO Software) (No Floppy support) 30-Day Guarantee. ADPTEK 1540A\$34.95 Ea.

PULLED 1 MEG X 9 70NS/80NS 30 PIN SIMM MODULES

Pulled and tested 1 Meg x 9 70ns/80ns SIMM memory module. Great for upgrading older machines for Windows 95. (Mixed Manufacture & Third party types.) 30-Day Guarantee.

1 MEGX9-70 30P SIMM (3 chip)	\$27.50 Ea.
1 MEGX9-70 30P SIMM (9 chip)	\$27.50 Ea.
1 MEGX9-80 30P SIMM (3 chip)	\$24.95 Ea.
1 MEGX9-80 30P SIMM (9 chip)	\$24.95 Ea.

NEW ADAPTEC EISA SCSI/2 CONTROLLER BOARD

High Performance board supports two floppies and up to seven SCSI devices. Note: No manual or software supplied with card. Adaptec AHA-1742A\$99.95 Ea.

PULLED NEC DUAL SPEED SCSI CD-ROM 5-1/4" DRIVE

Pulled dual speed SCSI interface CD-ROM drive in excellent condition. 5-1/4" half height with cream face plate. Caddy less design with 30-day guarantee. NEC M# CDR210 2X\$49.95 Ea.

NEW EXTERNAL 3-1/2" 720K FLOPPY DISK DRIVE

Made by Tandy for Tandy 1000EX Computer. Unit enclosed with cable for hook-up. Drive inside is a Teac Corp. Model #FD-35 FN-10-U. Color: White. Tandy Model #25-1061\$24.95 Ea.

NEW PCMCIA 10 MEG FLASH MEMORY CARD

Made by Sundisk. (Read/Write 5VDC.) Works with any laptop or PDA with PCMCIA ATA Spec. interface & software drivers. ("Software drivers not included") (Note: 10 meg is uncompressed capacity) Platform compatibility: HP 100LX/200LX IBM TP 350, 365, 500, 750, 755, and others, contact Sundisk for your specific model. Cards are Plug-Play Windows 95 compatible. Sundisk 408-562-0695 or www.sundisk.com SDP5-10 SUNDISK\$199.95 Ea.

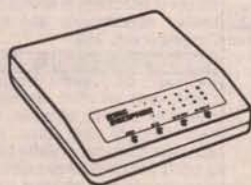
NEW MITSUBISHI 2.88 MEG 3-1/2" FLOPPY DRIVE

3-1/2" Half Height Mitsumi. Model #MF356-258MD. Tan face plate only. Mitsubishi 2.88M FDrive\$34.95 Ea.

We buy all defective Memory Boards/Modules from IBM, as well as computer scrap. Please contact Mr. Wiley Burke.

Write in 120 on Reader Service Card.

CALLER ID: Beltronics Model AD100 will display 100 names and numbers, repeat call indicator, block up to 100 numbers with a digital voice message without a subscription to call block service. \$50 + \$5 S/H. Also ATT model 125bx 70 number only, \$15 + \$5 S/H. American Express and COD accepted. Call SM Video to order. 703-620-4485.



RING DECODER. Look like a big business without big monthly bills. Up to 4 numbers on a single line. \$69.95. \$5 shipping. Visa. Logical Design Tools, Inc. 512-888-4535. Internet: <http://www2.interconnect.net/ldti/hom.htm>

RECEIVE COMPLEX MESSAGES ON YOUR BEEPER! "Your client has arrived," "Lunch meeting at 1:00," "Pharmacy has prescription ready." Easy to use code book shows you how to send thousands of messages. Save time and money by communicating your complete message at once without need for call-back. Works on all beepers! Act now and receive 2 code books. \$9.95 + \$1.50 S/H. Hypertech, 694 NE 76th St. #4, Miami, FL 33138.

CELLULAR HACKERS! Hot new software programs up to 39 different phones using your PC! All Motorola phones! NEC, Nokia, Panasonic, etc. 8.6 megabytes of info covers ESN/NAM programming, test modes, everything! Manual and diagrams to make own cables included! Guaranteed! No need to spend \$200 or more! Mention Nuts & Volts, get a copy of MPC programming software free! Order now! \$149.95 to: Bates, 733 N. Wells, Chicago, IL 60610. Phone: 312-213-7023.

CALL DIVERTERS. Multi-purpose uses. Programmable call routing. Store and forward technology for automatic call routing. Suitable for use in call routing to Alternative Carrier's network. Phone users can keep their location secret. We can customize diverters for your specific needs. Only one phone line operation needed! Call: New Advanced Technologies today for details! 514-458-3063, Fax 514-458-0798.

CELLULAR EXTENSION for all Motorola phones. Send us your phone or purchase one from us. Bag phones \$180, DPC 550 flip phones \$275. Will program yours for \$100. Call Bullseye Services, 864-934-2464 or E-Mail us at: bullseyeNVMarol.net

ESN READER connects between AR3000 or PRO-2006 scanner and personal computer, reads and logs to disk. Scanner and computer not included. \$995 US postal money order to Keith Perry, PO Box 816, Leander, Texas. SASE for info. 512-259-4770.

NEW INNOVATION keypad programmable digital Motorola phones for sale, complete with instructions \$550 each, two for \$1,000. Phone extensions \$80 each. F00000000 repair \$40. We buy used phones. Call 212-926-5284 or 1-800-216-BEEP #48410.

MINIATURE JACKFIELDS. Telephone industry type 19" rack mount jackfields with bantam jacks. Several styles available. Connectorized. \$40/unit. More info? Phone 415-665-5606 or FAX: 415-665-0616.

HOLD & MUSIC ON HOLD Only \$29 including shipping. Puts callers on hold and plays your customized message or music. Attaches easily to any phone. Send cheque to V. Eftechiou, 1402 Pine Avenue, Niagara Falls, NY 14301.

CELLULAR EXTENSIONS! Due to incredible demand we are again doing Motorola cell-phone programming! We will program any Motorola flip, brick, or bag phone! For details: 312-213-7023.

Javanco 40,000 FT² OF REAL BARGAINS:

- computer parts & software
- terminals
- TV/VCR service parts
- ICs
- sockets
- transistors
- diodes
- LEDs
- phone stuff
- resistors
- capacitors
- switches & relays
- connectors
- tie-wraps
- batteries
- fuses
- crystals
- oscillators
- fans, meters
- speakers
- wire
- "old junk"
- equipment racks
- knobs & hardware
- circuit boards
- subassemblies



We've slashed the price on an old favorite: used tested TeleVideo 925 terminals, excellent for use with serial packet radio TNCs. Our stock no. CPS-2188, \$19.95 each.



Call or write
for a catalog

Orders Only: 1-800-528-2626
615 244-4444
BBS 244-4445 FAX 244-4446

501 12th Ave S Nashville TN 37203 VISA/MasterCard/Discover

New Hours: 8:30a-5:30p M-F, 9a-1p Sat

Write in 158 on Reader Service Card.

SPECTRE

TELEPHONE PHREAKERS BLACK BOOK:

The largest and most indepth manual ever published on the how-tos of phreaking! Covers: AT&T and MCI services, loops, ANI, pay phones, caller ID, phone taps, ESDN, calling cards, tracing, diverters, toll fraud, ringback, CNA numbers, 800 & 900 systems, advanced signaling, trashing, exchanges, seizing trunks, DTMF decoders, operators, international dialing, WATS, ESS, 700 systems, extenders, coin toll services, teleconferencing, access numbers, ITT, step crashing, free long distance, mobile phones, boxing, area codes, NPA, prefix scanning, dialups, switching, bridges, call forwarding, PBXs, voice mail hacking, LASS, ANAC #s, Fortress, Sprint, DTMF generators, cans, War Dialer programs, answering machine hacking, phreak dictionary, secrets, 911, fax hacking. Includes construction details for over 80 phreaking boxes! Along with 6 programs that turn your computer into a Blue, DTMF, Green, Silver, 2600, or Red box! For Educational use only. Software manual \$22. SPECTRE PRESS, PO Box 5112, N. Muskegon, MI 49445.

PRICE BREAKTHRU! GBC now has Motorola loader phone systems for only \$575! Includes all cables, power supply, data transfer box, manual, programming software and assembled and tested unit! Order now and receive a free carry case and a copy of the Motorola Programming Bible! wow! Order now! 312-213-7023.

COMPONENTS

FREE ELECTRONICS CATALOG. Low, low prices for high quality overstocked parts. Call 817-473-1730. IME, PO Box 170415, Arlington, TX 76003.

CRTs CHEAP. Buy direct from the manufacturer, save money. Mfg. all CRT types over 45 years. **3 Year Warranty.** 19 inch tubes \$60, 25 inch \$90. We specialize in **HI Resolution** computer/video CRTs and complete repair of all monitors. T.M.C. 215-226-0749/223-0388 9:00am-10:00pm EST.

DON LANCASTER'S ACTIVE FILTER COOKBOOK is back in print. Autographed copies of the seventeenth(!) classic printing \$28.50. **SYNERGETICS PRESS**, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

HARD TO Find, hi-voltage electrolytics, caps, power resistors, xtals, plugs. Free catalog. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

WHITE-STAR ELECTRONICS

TEL: 405-631-5153 FAX: 405-631-4788

CONVERTERS:	20	50	100+
Regal CR-83	45	39	35
* New, Panasonic TZPC 145	75	69	65
DQN-5 (2 or 3) (unmodified)	45	39	35
DRZ-3 PJ (unmodified) 70 Channel Plain	35	32	29
DRX-3 PJ (unmodified) 60 Channel Plain	32	30	27

Call for **FREE** catalog.
405-631-5153



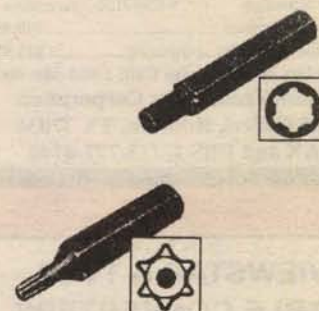
REMOTE CONTROL HAND UNITS:

	20	50	100+
Jerrold Replaces: 400/450/550	4.95	4.50	4.25
Scientific Atlanta 075/175/475	4.95	4.50	4.25
8600: On screen display	7.00	6.50	6.25
Pioneer: BR, 81, 82	4.95	4.50	4.25
All Panasonic	7.00	6.50	6.25
All Zenith	4.95	4.50	4.25
Tocom	7.00	6.50	6.25

Call for Oak, Hamlin, Regal-83, Regency, Texscan, and all others.

Tamper-Bit tools: (10-lot)

Jerrold compatible bits:	
1/4" Stacom Bit	\$8.00
Oval Round D	\$20.00
Torx Bit:	
Tocom T-8	\$8.00
Zenith T-10, T-15	\$8.00
Pioneer T-20	\$8.00
Scientific Atlanta T-20	\$8.00
Pio 63XX Oval	\$20.00
Bit Driver Handle	\$4.00



We carry most remote hand units. If you don't find the one you're looking for, we can locate for you.

Specializing in large quantities.

HOURS: Monday thru Friday 9 am to 5 pm Central Time.

Call for **FREE** catalog.

Write in 42 on Reader Service Card.

BATTERIES

REPLACEMENT
BATTERIES
ALL NEW • MADE IN U.S.A.

KENWOOD		
PB1	12v @ 1100 mAh	\$50.00
KNB-3	7.2v @ 1200 mAh	30.00
KNB-4	7.2v @ 2200 mAh	69.00
PB6	7.2v @ 760 mAh	35.00
PB7	7.2v @ 1500 mAh	49.00
PB8	12v @ 850 mAh	49.00
PB-13	7.2v @ 750 mAh	37.00
PB-14	12v @ 800 mAh	49.00
PB-18	7.2v @ 1500 mAh	47.00
ICOM		
7S	13.2v @ 1400 mAh	\$53.00
8S	9.6v @ 1400 mAh	51.00
BP7	13.2v @ 600 mAh	53.00
BP8	8.4v @ 1400 mAh	50.00
SA/SAT		
BP82, BP83A		
BP84	7.2v @ 1200 mAh 3"	\$39.00
BP85B	12v @ 600 mAh 3"	69.00

YAESU		
FNB-2	10.8v @ 600 mAh	\$19.00
FNB-4	12v @ 750 mAh	39.00
FNB-4A	12v @ 1000 mAh	55.00
FNB-17	7.2v @ 600 mAh	30.00
FNB-10S	7.2v @ 1200 mah	39.00
FNB-12S	12v @ 600 mAh	40.00
FNB-25	7.2v @ 600 mAh	35.00
FNB-26	7.2v @ 1200 mAh	44.00
FNB-26S	7.2v @ 1500 mAh	49.00
FNB-27S	12v @ 800 mAh	49.00
ALINCO		
EPB-10N	7.2v @ 700 mAh	\$36.00
EPB-12N	12v @ 700 mAh	47.00
DJ-F1T		
EPB-16N	7.2v @ 750 mAh	\$37.00
EPB-16N	12v @ 600 mAh	47.00
DJ-180, DJ580		
EPB-20N	7.2v @ 800 mAh	\$34.00
EPB-20NX	7.2v @ 1600 mAh	44.00
EPB-22N	12v @ 800 mAh	49.00

CAMCORDER		
Panasonic PB 80/88		
ORIG PAN		\$39.00
Sony NP77H	2400 mAh	39.00
Sony NP55	1200 mAh	29.00
Sony NP22	500 mAh	29.00
Canon 8mm	2000 mAh	36.00
Panasonic Palm	2400 mAh	39.00
JVC GR Type C	1500 mAh	36.00
Sharp BT 21/22	2000 mah	45.00
RCA/Hitachi 8mm	2400 mAh	39.00
ALL BRANDS AVAILABLE		

SALE!
ALL 7.2 VOLT
@ 1500 mAh*
**BATTERY
PACKS**
\$39⁰⁰

*EXCEPT FNB-35(S)(S)

MasterChargers®

MasterCharger I DELTA V,
RAPID CHARGER
ALL VOLTAGE 4.8v - 13.2v 1/2-2 HOURS

MasterCharger IIa
TAPER CHARGER
ALL VOLTAGE 4.8v - 13.2v 0 HOURS

DUAL CHARGERS

- MasterCharger i+l
- MasterCharger i+l+a
- MasterCharger i+l+a+l+a

*AUTOMATICALLY CHARGES TWO
BATTERIES AT THE SAME TIME

All MasterChargers
(Single and Dual) Feature:

- Interchangeable Cups
- Fully Automatic Operation
- Built in Overcharging Protection
- User Friendly
- More Than 50 Cups Available
- Optional DC Charger

NEW!

KENWOOD TH22AT/79A
PB32 6v @ 600 mAh
PB33 6v @ 1200 mAh
PB34 9.6v @ 600 mAh

YAESU FT-11/51R
FNB-31 4.8v @ 600 mAh
FNB-33(S) 4.8v @ 1500 mAh
FNB-35SS 7.2v @ 1500 mAh
FNB-38 9.6v @ 600 mAh

ICOM-W21AT/2GX
BP-157 7.2v @ 900 mAh
BP-157(S) 7.2v @ 1500 mAh
BP-132 12v @ 850 mAh

available with and without microphone

MOTOROLA
GP-300 7.5v @ 1200 mAh



BATTERY-TECH, INC. 28-25 215th PLACE, BAYSIDE, NY 11360
800-442-4275 • FAX 718-631-5117

SEND FOR FREE CATALOG • DEALER INQUIRIES WELCOME IN NEW YORK STATE CALL: 718-631-4275

Write in 81 on Reader Service Card.

NEW PRODUCTS WANTED

Established surveillance manufacturing company looking for ideas and inventions in the areas of surveillance, countermeasures, and cellular analysis.

We can develop, produce, and market on a partnership, profit sharing, or on an outright purchase basis.

Tech Support Systems

1040 Hamilton Court
Menlo Park, CA 94025
415-325-6691 • FAX 415-325-6693

SURPLUS SALE

200,000 WALL TRANSFORMERS



3.6 VDC	900 MA	2.25
12 VDC	100 MA	1.10
12 VDC	500 MA	1.75
12 VDC	800 MA	2.10
14 VAC	500 MA	1.75
16 VAC	1.25 A	2.95

Min 1000/type -- Call for other types

SURPLUS TRADERS

PO Box 276
Albany, Vt. 05440
Tel: 514-739-9328
Fax: 514-345-8303
FREE CATALOG!

WANTED

SIMMS

256x9	1x9	1x36
512x36	4x9	2x36

DRAM

1x1	256x4
-----	-------

**BEST PRICES PAID
CALL OR FAX NOW!**

ADD-ON America Corp.

(800) 576-2349

FAX (410)-987-3258

Mobil Printer

12 VDC
Datel Model
APP-M20



5" X 2.75" X 9"
Here it is! Brand new factory boxed, 20 column mobile printer. Rugged construction conforms to Mil STD 202E and 810C for shock, humidity and vibration. Extra tall character printing, paper advance and illuminated printout for easy night viewing. Quiet, non distracting thermal printing. RS 232 serial input. Low 360 mA standby/1.2 A printing power consumption.

BCD Electro \$29.99
214.343.2170 3.50 S&H per order

Serial Problems???

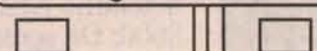
Use your PC compatible desktop or laptop computer to debug serial communications problems with **Serial**, our test tool for serial communications.

Serial works with the standard data rates and asynchronous serial formats commonly found in modern office and industrial environments. Suitable for development, service work, and end-user problem diagnosis.

- Easy to Use
 - Menu and Windows
 - Highly Configurable
 - Contextual Help
 - Autobaud Detect
 - Time Stamping
 - Custom font editor for EGA/VGA Screens
 - Saves Configurations
 - Extensive Manual
 - Block transmit ability
 - CRC/LRC generation
- Serial, with manual\$99.95
Cable for full duplex monitoring\$49.95
For Orders and Inquiries Call: 1-800-980-9806
Allison Technology Corporation
8343 Carvel, Houston, TX 77036
FAX and BBS 1-713-777-4746

BEEPER SPY!

gotcha!!!



Do you want to know if your spouse, boyfriend, or girlfriend is cheating on you?

Want to know if your teen is with the wrong crowd?

We offer you a duplicate pager of an existing pager. Now you both receive the same pages, same time!

Available anywhere in U.S.

For free information, call

1-800-672-4072

DEVICE PROGRAMMERS

XELTEK ROM MASTERII NEW PRINTER PORT PROGRAMMERS!

NEW PROGRAMS
EEPROM
PIC
GALS
FLASH
\$179



LOW COST
EPROM ERASERS



SUPERPRO LITE

\$269

PLEASE CALL FOR DETAILED
DEVICE LIST SUPPORT

\$429 REFURBS
\$300.

General Device Instruments New Web Page!

408-241-7376 Fax 241-6375 BBS 983-1234 E-Mail icdevice@best.com

**VIEWSTAR & TV 86
CABLE CONVERTERS
VOLUME &
NON-VOLUME CONTROL**

**SALES/SERVICE
VOICE 1-800-473-0506
FAX 1-800-488-0525**

**FOSS
WAREHOUSE
DISTRIBUTORS**
285 Schenck St.
N. Tonawanda, NY 14120

★BUYING LARGE QUANTITIES★ \$\$\$BEST PRICES AVAILABLE\$\$\$

**SCIENTIFIC
ATLANTA**

8536 THRU 8600

TOCOM
(GENUINE UNMODIFIED)

VIP
THRU
5507

JERROLD
(GENUINE UNMODIFIED)

DPBB212
THRU
DPV7,
DPBB7,
CFTs

ZENITH
1600 THRU 1622

PIONEER
5135 THRU 6300

Midwest's Largest Cable Brokers

(We buy quantities of one to one thousand units)

**NATIONAL CABLE BROKERS
(219) 935-4128**

GMRS Radios & Accessories

Maxon GMRS-210+3
10 ch. 2-5 watt portable Two-Way Radio. This is the ideal radio for React & GMRS repeater use.
NOW Only \$178⁹⁵

We stock all the Maxon accessories for this radio, plus Maxon and Yaesu base and mobile radios to 40 watts!! Best prices — Best accessories — Best shipping rates!!

NOW!!

View our products on the INTERNET @
<http://www.gmrs.comm>
Order directly from the Internet or call:

1-800-573-2256

Business Hours: 9 am to 5 pm Pacific (Mon.-Fri.)

S-COMM

P.O. Box 36, Scotts Mills, OR 97375
FAX: 503-873-2051

SPECIAL

ALL MAJOR BRANDS • ALL GUARANTEED

PROCESSOR	EPROM	STATIC RAM
80C31	8741	27C040
8202	8742	27C020
8219	8748H	27C010
8253	8749H	27C512
8255	8751	27C256
8254	87C51	27C128
8284	8752	27C64
82288	8755	27C32
FLASH EPROM		
28F010		2X32
28F020		4X32

AND MUCH MORE...

**WE BUY YOUR EXCESS
MEMORY AND CIRCUIT BOARDS**

SINACO ELECTRONIC • 818-705-1880 • FAX 818-705-1881

L.C.D. SALE

EARTH
Computer Technologies
"The Flat Panel Solutions Company"

CGA Display 640 x 200	\$29
VGA Display Mono	\$49
VGA Display Color Single Scan	\$125
Monochrome Controller from	\$99
Color LCD Controller	\$299

"Design Assistance Available"

Ph: (714) 448-9368 - Fax: (714) 448-9316
Email: <http://www.flat-panel.com>

\$ CASH FOR L.C.D.s \$ Free Catalog !!

CUT COSTS ON PC BOARD PROTOTYPE DESIGN AND MANUFACTURE!

State-of-the-art software and design stations. Very low cost, derived from our location, Mexico City. We specialize in small to medium size runs. Electrical diagrams, PCB layout, PCB manufacturing, Prototypes (tested and operational). Reverse engineering. Electrical diagrams, CAD/Laser printer diagrams, at a very low price.

Rep: V&V Machinery & Equipment, Inc.
Ph: (713) 397-8101, Fax: (713) 397-6220.
Plant in Mexico: Marketing Tec. Ph: 011 (525) 361-3351, Fax: 011 (525) 361-5996.

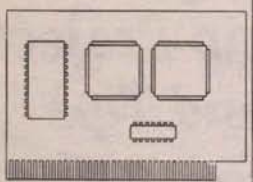
Become A Nuts & Volts Distributor!

**Sell copies of
Nuts & Volts
to your customers**

For information, write or call:

Nuts & Volts Magazine
430 Princeland Ct., Corona, CA 91719
(909) 371-8497
FAX (909) 371-3052

UNIVERSAL SOFTWARE KEY EMULATOR



One board replaces many Software Keys.
Learn and Emulate. Proven success.
Stand-alone operation. Set and GO.
Will handle large combinations.
\$179

E-TRACE INSTRUMENTS Corp.
210-493-4546 CARDS - COD

CCTV SPECIALS

Panasonic WW-BP114 • 1/3" CCD Camera \$179 • 0.1 lux • C5 mount • 380 lines ELC • Lenses \$39 & up • 24vac vtr \$10	Panasonic WW-BP102 • 1/3" CCD Camera \$229 • 0.3 lux • C or C5 mount • 380 lines • Accepts Auto-iris Lenses • 12VDC
Panasonic AG-6124 Time-Lapse Recorder \$795 Records 24 hours on a VHS Cassette! • 120vac • 300 lines • 24 Hr Audio & Video • Time/Date Gen	Panasonic TR990C • 9" CCTV Monitor \$149 • Desktop Monitor • 700 Line Resolution • Front Panel Controls • Rack Mountable • 120VAC

DETECTION DYNAMICS
 4700 Loyola Lane, Suite 119 Austin, Texas 78723
 (512) 345-8401 • FAX 926-0940
 CCTV CATALOG \$5.00 - REFUND W/PURCHASE

PROFESSIONAL 10 HOUR RECORDER Built like a BATTLESHIP



- Special Nuts & Bolts price \$149
- BUILT-IN voice activation add \$25
- Specifically engineered for long play recording
- 12, 14, and 16 hour versions available

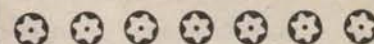
CODs OK. California residents add tax.
Sorry, no credit cards
(All they "do" is increase the prices...)

FREE 32 page
special equipment catalog!

VIKING INTERNATIONAL SINCE 1971
 150 Executive Park Blvd. #4800-N • San Francisco, CA 94134
 Phone: (415) 468-2066 • Fax: (415) 468-2067

TRUE TAMPER-PROOF

SECURITY SCREW REMOVAL BITS



The SUPER TORX Kit Includes:

T-10, T-15, T-20 & T-25
COMPLETE SET FOR ►► \$19.60

TOCOM 5503 Bit \$ 8.95
 TOCOM 5507 Bit \$19.95
 ZENITH PM/PZ-1 Bit \$10.95
 JERROLD Starcom Bit \$19.95
 PIONEER (Oval) Bit \$23.95
 OAK Sigma (Oval) Bit \$23.95
 *** Security Screws Available ***

TAMPER-BIT SUPPLY CO.

(310) 866-7125

FREE SAMPLE COPY!

ANTIQUE RADIO CLASSIFIED

*Antique Radio's Leading
Monthly Magazine*

Articles - Classifieds - Ads for Parts & Services. Also: Ham Equip. - Books - Telegraph - 40's, 50's & 60's Radios - Early TV - Auction Reports & more...
 1-Year: \$34.95 (\$51.95 by 1st Class)
 6-Month Trial - \$17.95. Foreign - Write.
A.R.C., P.O. Box 802-G16
Carlisle, MA 01741
 Call: 508-371-0512 Fax: 508-371-7129

Plug in HERE →
 to Maximize the
 Value of Your Oscilloscope!

NEW SuperProbe™

- Oscilloscope Triggering Devices**
- Complex triggering for digital circuits
 - Easy to use
 - Simplifies circuit debugging
 - Works with any oscilloscope
 - Models start at only \$99

PROGRAMMABLE DESIGNS INC.
 41 Enterprise Drive • Ann Arbor, MI 48103
 Phone: (313) 769-7540 • Fax: (313) 769-7242

TOGGLE SWITCHES AT WHOLESALE PRICES NEW SWITCHES - 125V OR 1/2 RATING AT 250V

FULL SIZE TOGGLE SW. 1/2" Dia.				
Type	Mod#	Cont. Rat.	Lead	Price 100-1000
SPST	S125	6A/125V	6" Wire	77 67
SPST	S128	4A/125V	Solder	57 47
DPDT	S126	5A/125V	Solder	77 67
DPDT/ON-OFF-ON	S127	10A/125V	Solder	1.17 1.06
MINIATURE TOGGLE SWITCHES 1/4" Dia.				
SPST	S131	6A/125V	Solder	57 47
SPST	S132	6A/125V	Solder	61 51
SPDT/MOM-OFF-MOM	S129	6A/125V	Solder	77 67
SPDT/ON-OFF-ON	S134	6A/125V	Solder	77 67
DPDT/ON-OFF-ON	S133	6A/125V	Solder	77 67
DPDT/ON-OFF-ON	S135	6A/125V	Solder	91 82
DPDT/MOM-OFF-MOM	S130	6A/125V	Solder	91 82
Black Plastic Boots For Above Switches 200/\$1.00				
SUB-MINIATURE TOGGLE SWITCHES 1/8" Dia.				
SPDT	S136	3A/125V	Solder	82 73
DPDT	S137	3A/125V	Solder	92 83
MOMENTARY PUSHBUTTON SWITCHES 1/4" Dia.				
SP-NOR OPEN	MS-1	3A/125V	Solder	26 22
SP-NOR CLOSED	MS-2	3A/125V	Solder	27 23
LEDs Mini or Jumbo, Red, Yellow, Green - \$12/100 • \$9/1000				
FERTIK'S ELECTRONICS				
5400 Ella St., Phila., PA 19120 • PH/FX 215-455-2121				

EPS EPROMS AS LOW AS 50¢

27C256	8748	27C010
27C512	8749	27C020
2732A	8741	27C040
27128	8742	27C1024
2764	8744	STATIC RAM
2716	8751	6264 2016
27C512-90	8759	62256 6116

Flash EPROMS, CPUs, UARTs, PROMs & much more...

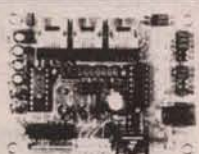
MEMORY

FOR ALL PCs & LASER PRINTERS
SIMM & SIP MODULE, D-RAMS
 1MEGX9 1X36 & 32 44256
 4MEGX9 2X36 & 32 1MEGX1
 256X9 4X36 & 32 41256

TEL: (818) 774-9444 • FAX: (818) 774-0822
WE BUY EXCESS INVENTORY

Convert RS-232 to RS-485 or TTL/CMOS for Only \$49.00

Communicate up to 1,000 feet, at up to 1 MEGA-BPS, full or half duplex, up to 32 units on one serial link, with 31 jumper options for flexible reconfiguration. LED indicators.



COMMUNICATIONS CONVERTER

- FULL SCHEMATIC AND DOCUMENTATION
- FULL FAMILY OF MODULAR DESIGNS
- RS-485/RS-422 REMOTE I/O MODULE KITS
- NETWORK SOFTWARE AND SOURCE CODE
- AUTOMATIC OR RTS UNITS AVAILABLE
- RJ-11/12 CONNECTORS OR TERMINAL STRIP
- TURN YOUR PC INTO A DISTRIBUTED DATA ACQUISITION AND CONTROL SYSTEM

R.E. SMITH

(513) 874-4796
 4311 TYLERSVILLE RD. • HAMILTON, OHIO 45011
 FAX (513) 874-1236

\$\$\$ LOWEST PRICES GUARANTEED \$\$\$

**MILLENNIUM 3
SCIENTIFIC ATLANTA
BASEBAND COMBO
\$180.00 Ea.**

**SCIENTIFIC ATLANTA
BASEBAND DECODER
\$85.00 Ea.**

**BOSS I & II
SCIENTIFIC ATLANTA, AND
PV & PBB SYSTEMS
\$220.00 Ea.**

**NOVAVISION 5700
PV & PBB SYSTEMS
\$225.00 Ea.**

DISCOVER



**ORDERS ONLY
1-800-254-2459
CUSTOMER SERVICE
(301)-390-3359**

AMERICAN EXPRESS



Robot Explorer™

The Robot Explorer™ newsletter is your guide to the world of intelligent mobile robots. Each of the 8 yearly issues is packed with robot explorations: from Antarctica, to the depths of volcanoes, to desktop mechanical creatures.

Build the newest robot kits, review the latest books, and receive expert guidance from master robot crafters.

Whether you're a professional robot designer, researcher, educator, hobbyist, or simply love to read about robots, Robot Explorer contains the in-depth articles you need to keep up to date with the quickly evolving world of intelligent machines. Eight issues for \$14.95.

Call Now!

MC/Visa **1 (800)GO-ROBOT 1(800)467-6268**
 POB 458, Peterborough NH 03458 603.924.6079
 \$14.95 North America \$29.95 World-Wide

CONTROL • MEASURE • INPUT

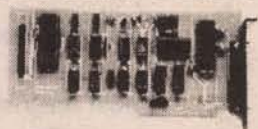
MODEL 40-\$99

- RS-232 interface
- 28 lines digital I/O
- Eight analog inputs
- PWM output
- Three stepper ports



MODEL 100-\$279

- 12-bit 100KHz A/D • Four analog outputs
- Three timer counters • 24 digital I/O



PRAIRIE DIGITAL, INC.
 846 SEVENTEENTH ST., INDUSTRIAL PARK
 PRAIRIE DU SAC, WI 53578
 TEL: (608) 643-8599 • FAX: (608) 643-6754

PCB's in Minutes From LaserPrint!*

8 1/2" x 11" Sheets * Or Photocopier Use household iron to apply.



PnP BLUE or PnP WET

For High Precision Professional PCB Layouts

1. LaserPrint
2. Iron-On
3. Peel-Off
4. Etch

Adds an Extra Layer of Resist for Super Fine Lines on Std. Clad Bds

20Sh \$30/40Sh \$50/100Sh \$100 Blue/Wet (No Mix)
 Sample Pack 5 Shs Blue + 5 Shs Wet \$20
 VISA/MC/PO/CH/MO \$4 S&H -- 2nd Day Mail

Techniks Inc. P.O. Box 463 Ringoes NJ 08551
 (908)788-8249

100% Money Back Guarantee-Dealer Inquiries Invited

NEW BOARDMAKER SCHEMATIC and PCB CAD

For IBM PC and compatibles

BOARDMAKER

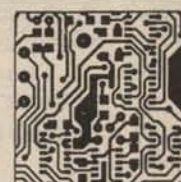
Entry Level — Only \$95
 Easy to use
 Dot matrix, laser, plotter
 Gerber & NC drill output

Advanced — \$395
 Accepts netlists
 Design rule checking

Board Capture — \$395
 Full feature schematic capture

Board Router — \$200
 Gridless autorouter

Free Demo



7840 ANGEL RIDGE ROAD
 ATHENS, OHIO 45701
 (514) 592-1810

Visa & MasterCard Accepted

Stamp Applications:

Putting the Spotlight on BASIC Stamp Projects, Hints, and Tips

by Scott Edwards

This is the 13th installment of *Stamp Applications*, so it's a perfect opportunity to talk about bad luck. In the microcontroller world, misfortune can take the form of garbled communications, power glitches, software bugs, hardware malfunctions, stuck motors, bad solder joints, electrostatic zaps, crazed users, and unread user's manuals. Some of these we can prevent; some we can control; and some we can neither prevent nor control, but only worry about.

When Good Luck is not Enough: Watchdogs and Error Recovery Catching and Correcting Operating Errors and a Few Bits of Boolean Logic

We'll start our exploration of bad luck with a class of applications known as "watchdogs." These are circuits that monitor computers or processes for a telltale sign of proper operation. If they don't find it, they attempt to fix the problem, or to notify someone who can. A watchdog can restart a stuck PC, cut power to a stalled motor, or signal a technician for help.

I'll also show you how to use the BS2's serial timeout feature to resend data if a peripheral (or other BS2) doesn't respond within a reasonable amount of time. And since unexpected resets are often a symptom of hardware problems, I'll demonstrate a simple method of detecting them.

Watchdog Timer

Many microcontrollers, including the PBASIC interpreter chip used in the Stamp and Counterfeit, include a watchdog timer. This is a circuit that periodically increments (adds 1 to) a counter. When the counter is full and increments one more time, it overflows. This causes the PBASIC chip to reset, almost as if the reset button were pushed. (I say almost, because the chip can tell the difference between a watchdog reset and a hardware reset.)

The chip itself has no control over the watchdog timer. It cannot stop it from incrementing the counter. But it can clear that counter to 0, making the watchdog start all over in its march toward a reset.

If the chip resets the timer to 0 often enough, the watchdog reset never occurs.

What good is this? Let's take an example from desktop computers. With just a glance at the instructions, you install the latest software on your PC. You fire it up, and a program screen appears. So far, so good. Then ... nothing. Press a key, move the mouse; nothing. Your PC is locked up. Sigh. Press `ctrl-alt-delete` to reset and try again.

In many control applications, there may not be a human standing by to decide when a program is locked up, so a watchdog timer serves the same purpose. The program is written in such a way that normal operation prevents the watchdog timer reset — but if the controller starts operating abnormally and forgets to clear the counter, the watchdog resets it.

PBASIC handles all the details of its own watchdog timer automatically, so you don't have to worry about it. But it can be useful to mimic the operation of the watchdog in your own programs.

For example, a reader asked me how to monitor a motor to ensure that it wasn't stalled. I suggested the watchdog approach illustrated in Listing 1.

The program is set up as a big loop. Each trip through the loop PBASIC checks an input from a switch that is periodically pulsed by the rotation of the motor. Figure 1 shows a suitable magnetic-switch arrangement.

When the Button instruction detects a switch closure, the program clears the watchdog counter. Otherwise, the program increments the watchdog counter. If the watchdog counter exceeds a preset value (determined by trial runs), the program judges that the motor is stalled, and hollers for help. The program in Listing 1 expects at least one pulse per second to prevent the watchdog from barking.

Other readers report using a similar method to monitor and reset PCs used in remote locations. They program the PC to periodically pulse an output line, such as one of the bits of the parallel port. Or they tap into the hard-drive activity light, if the application that's running uses the hard drive on a regular basis. The Stamp or Counterfeit monitors the pulse output. If no pulse arrives within before the watchdog counter reaches the maximum value set by the program, the Stamp or Counterfeit resets the PC,

either by closing a relay across the reset button, or by opening a relay between the PC and its AC power source. (The latter approach seems a bit brutal to me, but reports from the field are that it's effective.)

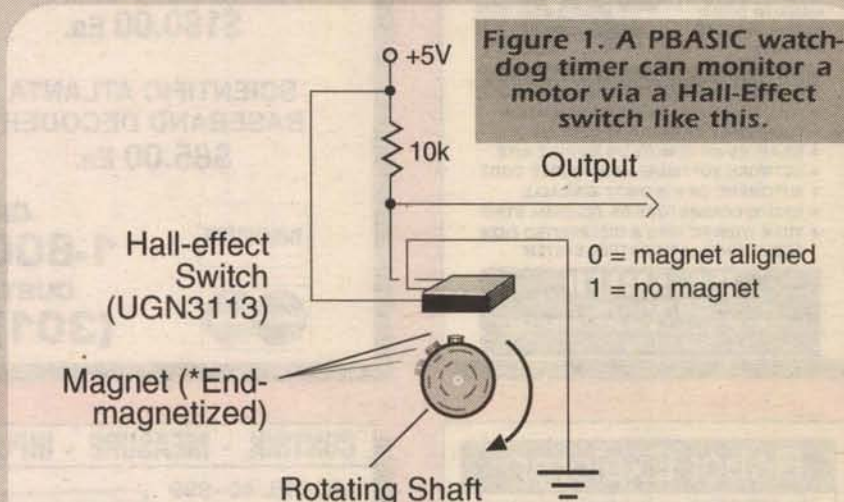
Serial Retry

The BASIC Stamp 2 (BS2) has many new instructions and improvements to existing instructions. One such improvement is the addition of a timeout feature to the serial-input instruction `Serin`. It allows you to specify a number of milliseconds (up to 65535; over a minute) for the Stamp to wait for serial data. If the data doesn't arrive within that time, the program goes to a routine that you specify.

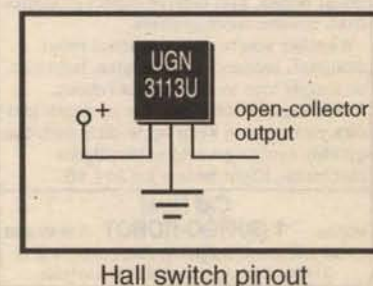
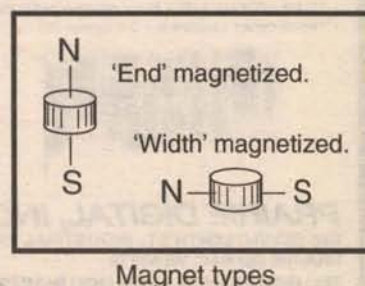
So, where the older Stamp could get stuck waiting for serial input, the new one can unstuck itself.

At first blush, I didn't see this feature as being terribly useful, since it addresses a symptom rather than the underlying problem. A corollary to Murphy's Law says that if you give up waiting for data now, the data you expected will arrive one millisecond later!

However, there's a common, real-world situation in which the serial timeout can be helpful. In two-way conversations between the BS2 and a serial peripheral or other Stamp, the timeout can provide



*To avoid affecting the balance of the shaft, use a button magnet that is magnetized across its width and mount it coaxially on the end of the shaft. The Hall-effect switch will turn on whenever the correct pole lines up with it.



Stamp Applications:

Listing 1. Watchdog Monitors 1-Hz Pulse (PBASIC 1)

' Program: WATCHDOG.BAS (PBASIC 1 detects motor stall)
' This program implements a watchdog timer — a device that monitors a pulsebeat and takes action if the pulse is absent for a predetermined amount of time. Applications for watchdogs include resetting a locked-up PC or cutting power to a stalled motor.

SYMBOL	state = bit0	' Trigger state for button command.
SYMBOL	dog = w1	' The watchdog counter.
SYMBOL	pulse_n = 0	' Pin number for pulsebeat input.
SYMBOL	pulse_p = pin0	' Pin name for pulsebeat input.
SYMBOL	btn = b4	' Workspace for button command.
SYMBOL	timeout = 300	' Max value of "dog" before alarm.

begin:
 let dog = 0 ' Clear watchdog variable to 0.
 state = pulse_p ^ 1 ' State = inverse of pulse pin.

' In the routine below, if the pulse input changes state, the OK routine shows us the count in variable "dog," then clears "dog" by looping back to the beginning of the program. Otherwise, it increments dog and, if dog exceeds the timeout value, shows the alarm message.

watchDog:
 button pulse_n,state,0,1,btn,1,OK
 let dog = dog + 1
 if dog > timeout then alarm
 Goto watchDog

alarm:
 debug "alarm!",cr ' Dog exceeded timeout.
 goto begin

OK:
 debug dog,cr ' Show us how high "dog" got.
 goto begin ' Then goto beginning to clear.

Listing 2. Serial Retry Overcomes Communication Glitches (PBASIC 2)

' Program: TIMEOUT.BS2 (Demonstrate serial timeout function of BS2)
' This program demonstrates how to use the serial-input timeout capability of the BS2. If the BS2, interfaced to a Stamp Stretcher 1B, does not receive a response to an analog-conversion request within 1 millisecond, it displays the message "Timeout" on the PC debug screen. If the Stretcher does return the data in time, the BS2 does not execute the error code, but displays the ADC result on the debug screen. In a real program, the error handler would probably be more elaborate — tracking the number of retries, lighting a warning light, sounding a buzzer, reinitializing the Stretcher, etc. Since communication errors are relatively rare under normal circumstances, you can unhook the serial connection between the BS2 and Stretcher while the program is running to demonstrate the error routine.

N96N	con	\$4054	' Set 9600 baud, inverted, no parity.
result	var	byte	' Store ADC result in this byte.
maxtime	con	1	' Allow this many milliseconds for reply.
comPin	con	0	' Connect this pin of BS2 to Stretcher "S" pin.

serout comPin,N96N,["****"] ' Reset the Stretcher.
again:
 pause 1000 ' Endless loop.
 serout comPin,N96N,["A"] ' Wait a second between tries.
 ' Send (A)nalog request.

' The line below is the key to the program. It waits "maxtime" milliseconds for serial start bit from the Stretcher. If the data doesn't arrive in time, it sends the program to the label "error." If the data does arrive, it stores it in the variable "result."

serin comPin,N96N,maxtime,error,[result] ' Get response.

debug ? result ' Display result.
goto again ' Do it again.

error:
 debug "Timeout",cr ' Serin timeout occurred: show error message.
 goto again ' Display "Timeout" on PC debug screen.
 ' Try again.

a way to resend an instruction if the peripheral doesn't respond.

For example, take the Stamp Stretcher 1B. This board lets a BS1 or BS2 access 16 additional I/O lines through a one-wire serial hookup at 2400 or 9600 baud. It also has a single-channel, eight-bit

a good point — the serial-retry concept would be especially useful in dealing with error-prone communications over the phone line. If you wrote a program to interact with a remote computer, online service, or bulletin-board system, chances are good that the connection would eventually fail. The serial

Listing 3. EEPROM Flag Locks Out Resets (PBASIC 2)

' Program: NO_RESET.BS2
' This program illustrates a method for letting a program detect the fact that the BS2 has reset since programming. This can be helpful in situations in which an unintended reset might cause loss of data, damage to equipment, etc. Note that an actual program should include some method for clearing the EEPROM reset flag other than just the data statement. Otherwise, the reset that occurs when a program is loaded, followed by the reset that occurs when the BS2 is disconnected from its programming cable, would trigger the reset-trapping routine. A button that causes the program to execute "write reset,0" would do the trick. To see the demo work, run the program. Watch the numbers go by on the debug screen, then press the reset button. The screen will display "Reset detected!"

x	var	byte	' Variable for busy work in demo.
reset	data	@0,0	' Write 0 to EEPROM address 0 as a flag to indicate that the program has not reset.

Demo:
 read reset,x ' Copy the value of reset into x
 if x = 0 then run ' If x is 0, then the BS2 has not reset, so run.
 debug cls, "Reset detected!"
 END ' If x is not 0, then a reset occurred, so stop.

run:
 write reset,255' Record first startup of BS2

busy_work:	' Dummy program to show activity:
debug ? x	' Display value of x on PC screen.
x = x+1	' Add 1 to x.
pause 500	' Wait a half second.
goto busy_work	' Repeat endlessly.

analog-to-digital converter (ADC).

To use the ADC, the Stamp sends the instruction "A" to the Stretcher with Serout, then waits for a response with Serin. Fine and dandy, unless the serial transmission got garbled and was received as something other than "A." The Stretcher is programmed to ignore characters that aren't in its command set, so the Stamp could end up waiting for a reply that isn't going to come.

If the garble was caused by some noise on the serial line, then it makes sense to try again by resending the instruction. Listing 2 shows how.

The retry loop of Listing 2 offers all sorts of opportunities for customization. You could add a counter to the loop that would try three times, then flash an error light. Or continue the program without the analog data. Or connect to a modem and send a message to a human maintenance technician.

That last one brings up

timeout would allow the BS2 to try again later.

Reset Lockout

Many different hardware problems can cause unintended resets of the PBASIC chip. Any glitch that takes the 5-volt power supply lower than 4 volts, even for a fraction of a second, can cause a reset. Voltage transients that disrupt the relationship of ground to the +5-volt rail, or that put noise on the reset line, can also reset the chip. Of course, a curious finger poking the reset button will do it every time!

There are lots of applications in which you want to prevent the Stamp from resetting, because a reset would disrupt a process, reinitialize variables, or cause the loss of data. Elsewhere in this issue is my BS2 Data Collection Proto Board. I set it up to gather data on battery voltage and ambient temperature to get a general idea about battery longevity and generate sample data for the article. If the BS2 were allowed to reset during the data-gathering period, some or all of the earlier data would have been lost. So I devised a trapdoor approach that prevented the program from starting over if reset. See Listing 3.

The idea is as simple as locking a door behind you. When the BS2 is first programmed, a Data directive writes 0 to address 0 of the EEPROM. The program reads this location, and, if it's 0, writes 255 to it and continues with the program. If the location does not contain 0, the program halts.

When the program is downloaded to the BS2, the door is unlocked, because the downloading process writes 0 to EEPROM address 0. When the program executes, it locks the door by writing 255 to it. If the BS2 resets, it will find 255 (locked) in the EEPROM address, and will stop.

This technique is also open to modification. In the data-logging application, I added a menu item that allowed the user to unlock the program manually. Another variation would be to use a switch instead of a byte of the EEPROM to lock out resets. The user would turn the device on, then move the

Stamp Applications:

switch from run to stop. The BS2 would check the run/stop switch at the beginning of the program, and continue only if it was in the run position.

In either case, a flashing light or buzzer could signal a reset that occurred after lock out.

BASIC for Beginners

Last month, we looked at the logic of IF/THEN instructions. We saw that PBASIC can look at a relationship such as "x < 10" and, if the current value of x makes that statement true, can go to a specific line in the program. In other words, PBASIC can make decisions.

We also touched on the fact that PBASIC can combine relationships using AND and OR to make decisions about more complicated matters. This month, we're going to look at the rules that govern this kind of logic. This logic not only works with IF/THEN decisions, it also lays the foundations for bit manipulations — efficient shortcuts for testing or changing the states of bits (1s and 0s).

Starting on familiar turf, let's take another look at a compound IF/THEN instruction.

IF pin1 = 1 OR pin2 = 1 THEN Alarm

So, if either of those comparisons — "pin1 = 1" or "pin2 = 1" is true, then the alarm goes off. Suppose we needed to make a table of all the conditions that could set off the alarm. It would look like this:

pin1 = 1	pin2 = 1	Alarm
FALSE	FALSE	OFF
FALSE	TRUE	ON
TRUE	FALSE	ON
TRUE	TRUE	ON

If those pins represent switches connected to doors and windows of a house, then that logic makes good sense. You want an alarm to go off in the event that bad guys are coming through the door, the window, or both. But suppose pin 1 represented the state of the door switches, and pin 2 was

Sources

For more information on the BASIC Stamp, contact:

Parallax, Inc.

3805 Atherton Road, #102, Rocklin, CA 95765

(916) 624-8333

FAX (916) 624-8003 • BBS 916-624-7101

E-Mail info@parallaxinc.com

Send questions, suggestions, or requests for future Stamp Applications to:

Scott Edwards Electronics

964 Cactus Wren Lane, Sierra Vista, AZ 85635

(520) 459-4802

FAX (520) 459-0623

E-Mail (CompuServe) at 72037,2612

Internet 72037.2612@compuserve.com

Scott offers Stamp-related kits, including:

The Counterfeit controller, a kit alternative to the BASIC Stamp, is \$29.00. Double- and quad-speed options are \$2.00 and \$4.00, respectively. The Counterfeit Development System, required to program Counterfeits, is \$69.00 and includes a 150-page manual, downloading cable kit, Parallax software, and one Counterfeit controller kit.

The Stamp Stretcher 1B adds 16 digital I/O lines, plus an eight-bit analog input to your Stamp I, Counterfeit, or Stamp II. It interfaces with these controllers via a 2400- or 9600-bps serial connections. The Stretcher 1B is \$30.00 in kit form, \$45.00 assembled.

Visa, MasterCard, and American Express accepted for phone/fax orders. Personal checks and money orders are welcome for mail orders.

The UGN3113U Hall-Effect switch is available from Newark Electronics. To get the number of the Newark office nearest you, phone their national administrative office at 312-784-5100; Canada, 416-670-4187; overseas, 312-638-7652.

the state of the arming switch (0=off; 1=on). You'd want the alarm to sound only if the system were armed and a door opened. The new IF/THEN instruction, just like the plain-English description, uses AND instead of OR:

IF pin1 = 1 AND pin2 = 1 THEN Alarm

The new table expressing all possible states of the pins and alarm would be:

pin1 = 1	pin2 = 1	Alarm
FALSE	FALSE	OFF
FALSE	TRUE	OFF
TRUE	FALSE	OFF
TRUE	TRUE	ON

If AND and OR were useful only with IF/THEN instructions, they'd still be darn useful. But IF/THEN

is only the tip of the iceberg. If you're just now encountering the power of logical operators like AND and OR for the first time, you're in about the same position as someone who's first encountered the arithmetic operators + and -. Not only are there more logical operators, but there's a whole system for understanding and applying them, called Boolean logic.

I want to leave you with a thought for next time, when we'll start digging around in the Boolean toolbox in earnest: AND and OR work on expressions that have two possible values, True and False. We could represent those states with individual bits, since they also have two possible states, 1 and 0. What if there were a way to apply logical operators directly to bits, or groups of bits in PBASIC? There is, and some of the most powerful techniques for writing efficient programs spring from this application of logic. **NV**

COMPONENTS cont.

CAPACITORS, HIGH voltage, 50uF, 3.5KW new. \$25 each. Megastar 702-386-2844.

ELECTRONIC COMPONENTS BOUGHT:

All transistors, diodes, resistors, capacitors, ICs, milspec, commercial. FAX LABB Associates, 215-364-5415.

RESISTOR SELECTION

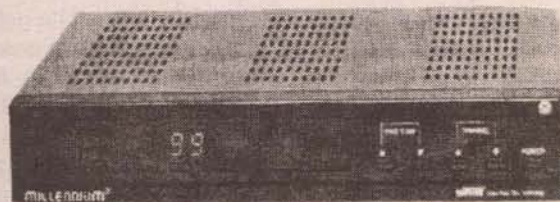
10,000 total quarter watts. Fifty each of 200 different values. \$95. Murphy's Surplus, 401 North Johnson Ave., El Cajon, CA 92020. 619-444-7717.

PCB ASSEMBLY.

Experienced thru-hole circuit board assembly at low rates. All work fully guaranteed. Let us save you \$. Call 614-354-4791.

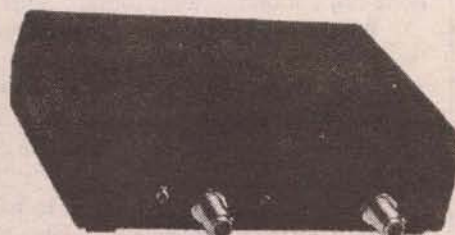
CALL 1-800-673-6178

ONE STOP SUPPLIER



MILLENNIUM CONVERTER

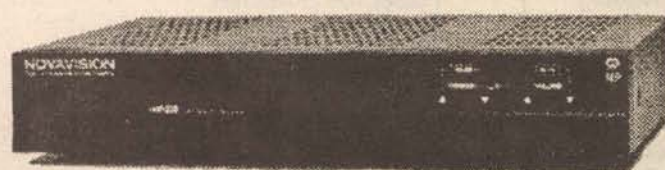
\$69.00



ZAPATO 102

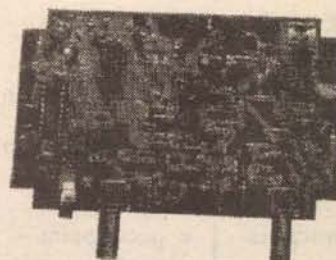
1-5	\$39.00
6-10	\$35.00
11-25	\$32.00

DOZENS OF OTHER CONVERTERS AVAILABLE
CALL FOR QUANTITY PRICING



NOVAVISION CONVERTER

\$179.00



ZAPATO 101

1-5	\$32.00
6-10	\$30.00
11-25	\$28.00

WE SHIP THE SAME DAY
90 DAY LIMITED WARRANTY

OPEN MONDAY - SATURDAY FROM 9:00AM TO 5:00PM

CALL 1-800-673-6178



Maxon motor-encoder-gearhead. Swiss made. 8000 RPM motor with 81.2:1 reduction. Output torque 2 Nm continuous. 80% efficiency, ideal for battery operation. 5mm shaft, 4 3/4 overall length. Hewlett-Packard encoder.....\$49.00 Postpaid

Welch Allyn Bar Code Reader. Model 3600/A-111 "Scanteam 3600". Current Production Compact Unit. With Software 1 1/4" H x 3 1/2" W x 3 1/2" D. 22" Good Read" LED indicator..... \$99.00 PP



600 Watt Power Supply By Lambda. Usually I don't get excited by power supplies because there are too many on the market. This one is exceptional, 15V 24 Amps, 15V 12A, (2)15V 3A, 5V 12A. Instructions to series or parallel outputs provided. 92% Efficiency. Mini-fan cooled, Size 2"x4"x12".....\$59.00 Postpaid.

Best wishes for the new year. I now take credit cards, cash, check or COD orders. Everything unconditionally guaranteed. **Franklin G. Fink** CEO, CC&BW.

Vision & Motion Surplus

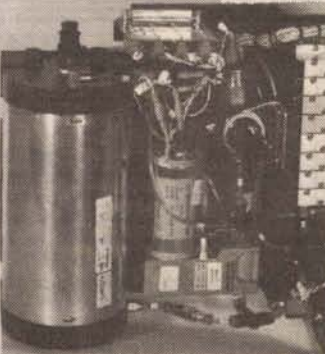
241A East Main Street
Westboro MA 01581
508-366-8370

Tektronix 1240 Logic Analyzer with Probes..\$800.00

17" Sony (Hewlett Packard 98789A) Monitor. Checked out, good bright tube. RGB inputs (BNC) sync on green. Not compatible with IBM unless modified. Compatible with Mac when retuned. Suggest you buy this only if you are familiar with monitors, or wish to experiment.

40 lbs.....\$150.00
Cable, VGA to BNC R,G,B,H,V.....\$30.00 Postpaid. Monitor professionally modified to add H,V Input add.....\$75.00
Monitor professionally retuned for Mac.....add \$50.00

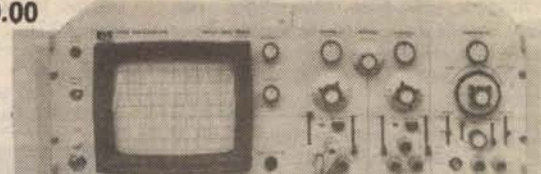
Electro-Pneumatic components.



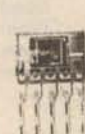
The preferred robotic motion. Muscle-like smooth action, sustained high peak energy from reservoir tank. Now State of the art pneumatics at affordable prices.

Power and Control Unit. Contains pump, reservoir tank, micro-adjustable regulator, multiple quick-disconnects, and eight electrically controlled valves. Size 12"x15"x6".....\$149.00 PP

Schrader Bellows Linear Actuator. Quick disconnect fittings, adjustable limit switches 2.5"x2.5" B40 4100B 25.....\$22.00
Size 1 3/4"x1 3/4"x1 3/4" M25 4100B25.....\$19.00 Postpaid.
Rotary Actuator. Quick connects, adjust. limit switches SMC CRB 1BW30-180S 2.5" L, 2" Diam.\$21.00 Postpaid
Hi-Rotor PRN003-90-90 SR3 (?What is it?).....\$20.00 Postpaid



Oscilloscope Special! Hewlett Packard 1200B for audio and low level applications. 100 microvolt sensitivity, 500KHz bandwidth, large screen. One of the best scopes for low levels ever made. Sold by other surplus houses at several times our price. Checked out, in ex++ condition.....\$175.00 Postpaid.



OPT101 Photodiode and Amplifier IC, works with 3V single supply 0.01% nonlinearity. Perfect for color and spot meters and other low level sensing and measuring. 5 pin vertically mounted SIP..... \$5.00 Postpaid

Sony XC37 2/3 inch Scientific Grade CCD Camera. NTSC Output. High Resolution, With quality Dormeyer Computar 25mm F1.8 lens, power cable (12 VDC). Added bonus while they last-extension tube set for macrophotography \$15.00 with purchase of camera.\$260.00 Postpaid

Linear Motion Slide for Numerical Control. 12 inch motion. Non stretch timing belts on each side drive platforms to which a cross member can be secured. Beefy gearhead Maxon DC motor with HP encoder drives both belts through cross-shaft for parallel motion. Recommended for light to medium applications such as mat-cutting, PC drilling or signmaking. Includes opto limit switches.....\$99.00 Postpaid



4" Travel Recirculating Ball Slide. Maxon motor-gearhead-encoder. Suitable for precision optical motion....\$69.00 Postpaid

Write in 80 on Reader Service Card.

FLEXIBLE WAVEGUIDE. New, silver plated, rubber coated, six-inch length WR90, sealed pouch. 4/\$25. Wade 309-523-3262.

74LS244 CHIPS in DIP package style, thousands available for about 2 cents each plus shipping. Other types such as 74HC244, 74HCT244, 74ALS244. Chips are used solder pulls in good condition and will be sold by weight. Visa and MasterCard accepted by phone. Call MCP, 503-754-4904, FAX 503-758-5331.

RCA COLORAMA CRT 19GWP22/19EYP22, approx. 200 hours use time, free, Chicago area, 708-773-1309.

FREE HEATSHRINK sample pack. Send SASE to: APTEC Electronics, PO Box 101, El Segundo, CA 90245-0101.

RESISTORS 20 FOR \$1. LEDs 4 for \$1. Catalog \$1. ZIPFAST, Box 12238, Lexington, KY 40581-2238.



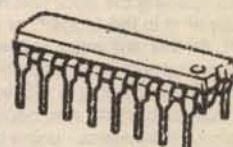
THE ELECTRONIC EXPERIMENTER'S JOURNAL. It's part catalog, part magazine, part data book. Kits, plans, schematics, computers, parts, articles, ideas, and application notes. Get your FREE copy today by calling 1-800-423-4499 or FAX to 513-531-4455. Debco Electronics, 4025 Edwards Rd., Cincinnati, OH 45209.

RF TRANSISTORS and tubes. MRF455, 2SC2879, 2SC1306, 2SB754, 2SC1969, 2SC2312, TA7222AP, 7808, 2SC1947, tubes, 4CX250B, 30KD6, 12DQ6, 3-500 graphite. Electrolytics all types. Westgate, 1-800-213-4563.

AXIAL ELECTROLYTICS. New Nichicon miniature 22 MFD at 450VDC. Eight or more \$1.25 each, postpaid. Write, phone, or fax for free flyer. DH Distributors, POB 48623, Wichita, KS 67201-8623. 316-684-0050 V/F.

COMPONENTS INTEL 27C020-150V10 \$2, LATIC GAL20XV10B-20LP \$.50, MMI PAL20L10ACNS \$.50, MAGNETEK FS16-150 \$.50. All parts unused, send check or money order to LLOYD's, 28410 Front St. Ste. 104-184, Temecula, CA 92590. \$3 for postage and handling.

EXCESS INVENTORY WANTED: Commercial and military. ICs, diodes, transistors, caps, relays, connectors, wire, and cable. M&M SALES, 602-807-8604 OR FAX your list to, 602-807-3320.



WANTED: EXCESS ELECTRONIC INVENTORIES, ICs, MEMORY, EPROMs, PALs, LEDs, CIRCUIT BOARDS, DIODES, AND TRANSISTORS. CALL ACTIVE MICRO, 310-494-4851 OR FAX 310-494-4913.

BATTERIES

For Every Need!

NiCad • NiMh • Lead Acid • Lithium • Alkaline

UPS • Computer • Radio Inserts
Alarm • Cellular • Communications
Survey • Camcorder • Memory Backup
Custom Packs ... And More!

Stocking All Major Manufacturers including:

Sanyo • Gates • Powersonic • Saft • Yuasa • Tadiran

800-346-0601

Fax (407) 682-4469

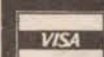
TNR Technical, Inc. • 279 Douglas Ave. • Altamonte Springs, FL 32714

Write in 196 on Reader Service Card.

SOLAR ELECTRICITY LOWEST PRICES UNDER THE SUN!

TOLL FREE **1-800-842-5678** (24 HRS)

CALL COLLECT (619) 581-0051 FAX (619) 581-6440 E-MAIL SOLAR@CTS.COM



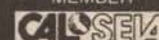
SOLAR ELECTRIC INC.

AT THE ROSE CANYON BUSINESS PARK

4901 MORENA BLVD. #305

SAN DIEGO, CA 92117 U.S.A.

MEMBER



WE FEATURE SIEMENS TRACE ENGINEERING AND OTHER FINE PRODUCTS

Write in 41 on Reader Service Card.

Nuts & Volts Magazine/March 1996 97

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Now selling memory. We can beat any printed price in Nuts & Volts. Call 1-800-4-MEMORY now! Voice/FAX.

CAPACITORS, HIGH voltage, 50uF, 3.5KW new. \$25 each. Megastar 702-386-2844.



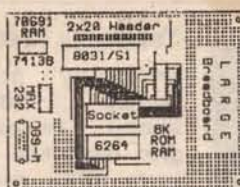
CRYSTALS: RADIO and microprocessor, low price, fast delivery, all brands, prototype, production runs. Velco Electronics, 716-924-2073, FAX: 716-924-2136.

CHIP/DIE COMPONENTS large quantities of diodes, transistors, ICs, capacitors and resistors. APTEC, 310-640-7262.

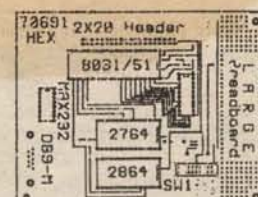
CATALOG. PARTS: RF, analog, digital, audio. Two stamps. Johnson Shop Products, Box 2843, Cupertino, CA 95015.

MICROCONTROLLERS

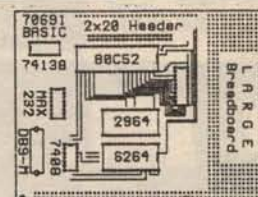
MAGPRO-11 KIT. Download \$19 files to internal EEPROM via RS-232, \$45. MagTroll-11 KIT, HCx11 single board computer \$39. Includes instructions and disk. \$3 S/H. Send check to: **Magicland**, 4380 S. Gordan, Fremont, MI 49412. 616-652-2368. 8 am to noon Eastern.



ECONOMICAL 8051 SBCs. The 70691RAM, a complete SBC with large breadboard area, serial port, 8K RAM/ROM and 40 pin Header for Easy interfacing. Also includes programming software (3.5 or 5.25in), documentation and sample .ASM codes. Assembled/ Tested \$50 plus S/H. Suncoast Technologies, PO Box 5835, Spring Hill, FL 34606. 904-596-7599. V/MC accepted.



8051 SBCs with Bootstrap Loader. Economical SBC with 128 byte memory, 24 I/O Ports. Contains preprogrammed Bootstrap software that allows loading of .OBJ files to EEPROM through Serial Port of PC. Run programs without burning EPROMs. IBM DOS compatible Utility Disk included (3.5 or 5.25 in). \$59 plus S/H. Also; Learn Assembly code with the perfect 70691HEX companion; "Assembly Language BASICS". A 64 pg. booklet devoted to the programming of the 8031/51. Written with the novice programmer in mind. \$15 plus S/H. Suncoast Technologies, PO Box 5835, Spring Hill, FL 34606. 904-596-7599. V/MC Accepted.



PROGRAM THE 8052 in BASIC with our inexpensive development SBC. Assembled/Tested board contains Intel's BASIC-52 Interpreter (80C52). Allows programming through serial port of PC. Also contains 8K RAM/ROM, Hi-address decoder, large breadboard area, 40-pin header and 2864 EEPROM that allows auto-startup of your saved programs. Programming software also included (3.5 or 5.25 in.) \$70 plus S/H. Also learn how to program your purchase with the "BASIC-52 User's Manual." A 150-page book containing the proper usage of all commands/statements, \$20 plus S/H. Suncoast Technologies, PO Box 5835, Spring Hill, FL 34606. 904-596-7599. V/MC Accepted.

ANTIQUE ELECTRONICS

WESTERN ELECTRIC WANTED: 1927-1960S. Amplifiers, speakers, tubes, etc. Free offer. 1-800-251-5454.

DID YOU KNOW that old personal computers, monitors, modems, electronic cash registers, and even old calculators contain valuable IC chips that are plated with pure gold! My "Big Color Photo" (8" x 10") shows over 25 of the most common gold plated IC Chips and the price I will pay for them. Chips are shown actual size. The price of gold keeps climbing higher and higher and is making it worthwhile to tear apart old equipment. To order "The Big Photo" send \$15 to Jim Sciuto, Box 128, Methuen, MA 01844.

CRYSTAL SETS. Parts, plans, books, kits. Largest source in the world. Catalog \$2. MIDCO, PO Box 2288, Hollywood, FL 33022.

MICROPHONES: WANTED older broadcast quality microphones from Altec, RCA, Western Electric, Shure, American Microphone, and others. Also literature and catalogs on the same. Call or FAX with a description and asking price. Mike 408-749-0130 days or 408-749-1323 FAX.

I WANT your LED watches! I collect LED and novelty LCD watches. I prefer good condition or better. Documentation and presentation boxes a plus. Any Seiko TV watches? Mike at 214-242-1271 or lillthug@metronet.com

WE STOCK all SAMs radio, TV, CB, car radio, transistor radio, tape recorder and VCR photo facts and book series. We also stock vacuum tubes. 2,000 types available. Tell us your needs. Schwendimans, 208-522-2492, 910 Lincoln Ave., Idaho Falls, ID 83401. VISAMC.

STOCK TICKERS, Edison, Western Union, Postal Telegraph, or others. Telegraphy instruments, keys, sounders, etc. Railroad dining car china, silverware, holloware, linens, menus, time tables. 217-345-6771, Goodman.

gateway
ELECTRONICS, INC.

8123 PAGE BLVD * ST. LOUIS, MO 63130
(314)427-6116

9222 CHESAPEAKE DR. * SAN DIEGO, CA 92123
(619)279-6802

2525 FEDERAL BLVD. * DENVER, CO 80211
(303)458-5444

MAIL ORDERS CALL TOLL-FREE
1-800-669-5810

FAX ORDERS (314)427-3147

GATEWAY GET'S A LITTLE MUSCLE

That's right, Muscle Wires have come to Gateway! At room temperature, Muscle Wires (thin highly processed strands of Nitinol) are easily stretched by a small force. However, when conducting an electric current, the wire heats and changes to a much harder form that returns to the "unstretched" shape - the wire shortens in length with a usable amount of force! Pretty cool, huh! There is a really cool project book (\$17.95) that explores the properties of muscle wires, details design, construction, and power of muscle wires, and provides detailed instructions for fifteen Muscle Wires projects. Gateway has a starter kit with different diameter Muscle Wires get you going (\$19.95), a meter of 100uA muscle wire for \$14.95, and a nifty thing for the kids called Live Wires -- similar to muscle wires but activated by hot and cold water -- it "remembers" whatever shape you bend it into! (\$2.95)

PHOTON MICROLIGHT \$10.00

8 Candellas of bright red or yellow light, visible over a mile away! This super-bright LED is secured in a tough ABS case and runs on a 3V lithium battery (included!) It won't burn out because it is an LED! Specify red or yellow when ordering. Battery has a 5 year shelf life and lasts up to 11 hours. (replacement battery \$0.98). Great for home or office use, popular with fire and rescue professionals, pyrotechnicians, stage performers, and more.

MONITOR AMERICA! \$29.95

The bible for scanner users, this new 3rd edition national communications guide is bigger and better than ever. Wherever you are in the U.S., you can enjoy your scanner and keep up with your favorite scanning activities. Frequencies, maps, codes and descriptions of State Police/ Highway Patrol, Federal Government, U.S. Military, Colleges & Universities, Marine Radio, Cellular and Cordless phones, Civil Defense, Fish, Game & Wildlife, and more. Special sections on race car teams and tracks, Disneyland and Disneyworld, Amusement parks, Museums and concert halls, news media...the list goes on and on!

1300°C TORCH special price \$8.95

Powered by a pocket butane lighter, this compact torch is great for setting things on fire! (O.K., on a more practical note, you can use it for soldering, quick heating shrink tubing, lighting the campfire, and all kinds of other stuff!) Features a built-in piezo electric igniter, and gas control switch for easy one-hand operation. Requires no special tips, and the included gas container is refillable with butane fuel or can be replaced with a Scripto-type cigarette lighter. Great for home, auto, or office!

THE VOICEBUTTON DIGITAL VOICE RECORDER \$7.95

Imagine opening the door and hearing "Welcome to our office", or pressing a button to hear "Your supper is in the fridge!", or even pushing on a picture of a T-rex and being greeted with a dino-roar! All this and more is possible with this digital voice recorder and a little creativity! You can record up to a 9 second message or sound effect on the voice chip. No disk or tape is required. The recording is played back anytime the press-down switch is activated. Includes built-in speaker and hook-up diagram. Runs on 4 AA batteries (not included.) Approx. dimensions - voice box 2-3/4"x2-1/2"x1-1/8" press-down switch 2"x1-1/2"x1"

WEB SURFERS! VISIT US AT OUR NEW HOME ON THE INTERNET! WWW.GATEWAYELEX.COM

ALL BAND SCANNER ANTENNA \$14.95

Equipped with a BNC connector and a red antenna cap, this 8" long antenna can increase the gain of your hand held scanner. Frequency coverage 25 - 1000 MHz. Antenna Impedance 50 ohms

pinhole camera with audio!!! \$175.00

The latest in miniature surveillance...A tiny on-board camera (1-3/16" square, only 1/2" thick!) with a 3.7mm pinhole lens (1/16") and audio! Techle specs are: 420 lines of resolution, 0.1 LUX. Automatic focus 2" to infinity! It can be housed in almost anything due to its small size. Requires 9-12 VDC and a little imagination. Ideal for GI Joe's reconnaissance missions, keeping tabs on Uncle Herbie's retirement activities, or even enjoying your own version of Candid Camera! hook-up instructions included.

THE FINE PRINT: PRICES SUBJECT TO CHANGE WITHOUT NOTICE * GATEWAY IS NOT RESPONSIBLE FOR PRINTING ERRORS * MASTERCARD, VISA AND DISCOVER ACCEPTED * YES, WE'LL TAKE YOUR CHECK - SORRY, NO C.O.D.s * \$10 MERCHANDISE MINIMUM ON MAIL ORDERS * SUPPLY OF SOME ITEMS IS LIMITED * PRICES DO NOT INCLUDE SHIPPING * UPS GROUND SHIPPING/HANDLING WITHIN THE CONTINENTAL U.S. (ITEMS REQUIRING ADDITIONAL AMOUNTS ARE NOTED)...\$4.25 FOR THE FIRST ITEM, \$0.50 FOR EACH ADDITIONAL ITEM. RESTOCKING CHARGE MAY BE ASSESSED ON RETURNED ITEMS.

Q: What has 4 legs and an arm?
A: A happy pit bull!

30 pc. TAMPER-PROOF SECURITY BIT SET \$16.95

Drive bits with hollowed tips designed for those security screws often found in computers and other modern equipment. This set includes 9 different sizes of Torx bits (T7 thru T40), 4 sizes of square drive bits (S0 thru S3), 7 different sizes of hex bits (from 5/64 to 1/4), as well as flat and Phillips bits, a socket holder, a 1/4" adaptor, and a magnetic tipped handle to accommodate all the bits in the set. Handle also has a storage compartment for pocket use, and the complete set comes in a sturdy plastic storage case. Ideal for the bench or toolbox.

HOW TO KEEP YOUR VCR ALIVE \$24.95

Cleverly subtitled VCR REPAIRS ANYONE CAN DO, this book is one of our best sellers. This is probably true because you really don't have to read the whole book! Organized by symptoms, How To Keep Your VCR Alive is written in an easy-to-understand format without the usual technobabble. Illustrations and appendices provide additional help as you endeavor to keep your vcr up and running.

CASH FOR your old telegraph instruments of any kind, also books, signs, etc. Have a few items for sale. Goodman, 636 Grant, Charleston, IL 61920.

TRAM PARTS. Impossible to come by D201, D60 hardware, parts and components. New old stock, mint condition meters, dial indicator face plates, multi-position rotary switches, IF cans, crystals, chokes, capacitors, coils, and much more. Willing to sell entire lot. Serious inquiries only. Include phone number. Mike Rogers, 354 Frost Hollow Rd., Steele, AL 35987.

RADIO AND TV tubes from 1927 to 1977. \$1 for list to: Preller TV, 208 South 2nd St., Augusta, AR 72006. Ph. 501-347-2281.

BOOKS & TUBES: Old radio and electronics books, manuals, magazines, etc.; also physics, math, science; new and used vacuum tubes for sale. Booklist \$1 (stamps OK), Tubelist SASE. WANTED: Old QSL cards. Softwave Communications, 1515 Sashabaw Rd., Ortonville, MI 48462.

TUBES, NEW, up to 90% off. SASE. Kirby, 298 W. Carmel Dr., Carmel, IN 46032.

I HAVE a very sick Kolster radio model 60 which will only "hummm" when powered. Seeking experienced repair person in DC/MD area. PO Box 59308, Washington, DC 20012-9308 or 301-422-6141.

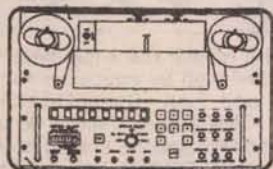
VINTAGE SERVICE data from 1923 to present. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

MCINTOSH MX-110 stereo tuner/preamplifier, tube-type, in mint condition, working. Built 08-27-69. Serious inquiries only. Jerry 806-256-3405, if no answer leave message.

WANTED: PRE 1960 car radios and vacuum tubes. Preferably pre-war car parts. 815-726-1531. R. Kapteyn, 112 Bissel St., Joliet, IL 60432-3002.

AVIATION ELECTRONICS

ALTIMETER, SIMULATOR looks like the real thing. \$25 ea. includes mailing. Other instruments avail. APTEC, PO Box 101, El Segundo, CA 90245-0101. 310-640-7262.



WANTED: LITTON test equipment used by airlines & military PN 673785-03. Called, CCU, F&N. 4920-00-070-1257, or 4920-01-024-5336- suitcase size. Has old reel-to-reel punch tape. Call 941-575-0138 or FAX 941-575-2361.

AVIONICS RACKS for testing flight simulation for airplane that was cancelled, never installed. 4 yrs. old in excellent shape. Test equipment HP 3457A (new) \$4,379, Xytron AR-17-17B \$400, Neslab CFT-38 (unused) \$900. 817-267-9700.

AIRCRAFT BATTERY 24-volt 31AH. Acid not included. New! \$250 ea. APTEC Electronics, 310-640-7262.

BUY, SELL, trade avionics equipment. IFR, Collins, TIC, MIL, HP, Linaire, King, shop equip. Kingsley, Magtrol, Setra. Need Litton Inertial System LTN-51 used on C130, P3 or Gulf-stream Aircraft. 941-575-0138, Fax 24 hrs 941-575-2361.

PUBLICATIONS

CATALOG. PARTS: RF, analog, digital, audio. Two stamps. Johnson Shop Products, Box 2843, Cupertino, CA 95015.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-842-5953, FAX: 818-845-3613.

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

MILITARY MONITORING GUIDE. New book covers all phases of Military Monitoring. Military Frequencies All services, US Military bases, Military Black Projects. Major Air Force Installations, Monitoring Equipment and Systems, Navy/Coast Guard and more. \$19.95 plus \$4 Priority Mail. UNIVERSAL ELECTRONICS, 4555 GROVES ROAD, Suite12, COLUMBUS, OH 43232. 614-866-4605.

HOT BUSINESSES, careers, better health, amazing opportunities. Dealer/agent programs. Complete details, free. Fabtronics Wholesale, 5714D Wautoma, Hilton, NY 14468. 716-392-1231.

50 MHz DX bulletin and Sanyo PC Hackers Newsletter, monthly publications from Victor Frank Publishing. \$20 annually third class, \$25 first class, Canada and Mexico, \$30 other. SASE for sample to 12450 Skyline Blvd., Woodside, CA 94062-4541.

RADIOMAP™ TRANSMITTER location report. Transmitter sites in your area researched and marked on a custom, color map. For brochure, send #10 SASE to Robert S. Parnass MS, Radio Electronics Consulting, 2350 Douglas Rd., Oswego, IL 60543-9794.

SECURITY ADVISOR! Fight back at crime book with hundreds of tips, tricks, answers, set-ups, applications. Learn about locks, alarms, safes, cops, fire, vehicles, safety courts, satellites, surveillance. Write Simdex, PO Box 211, Lazo, BC Canada, V0R 2K0. Fax 604-339-0995.

WHAT!? YOU don't have the new **TELECODE** 20 page 1996 CATALOG!? It's free! 520-782-2316.

"POWER UP!" How to make commercial-battery adapters for: military radios, mine detectors, night scopes, field telephones, etc. Instructions/diagrams. \$14.95, plus \$5 S/H (\$6 Canada). NYS res. add \$1.65 tax. CRB Research, Box 56-NAV, Commack, NY 11725. Phone: 516-543-9169.

24 Hr. Shipping

To Order Call 1-800-292-7711 Fax: (847) 541-9904

Quality Kits for Hobbyists and Students

Micro-Master® MM-8000K

\$99.95

Starting from scratch, you can build a complete computer system. Elenco's Micro-Master® Trainer teaches you to write the initial instructions in permanent memory in a 2816E PROM. Teaches you all about input and output ports and computer timers. Build your own keyboard and learn how to scan keyboard and display. No previous computer knowledge required. Simple, easy-to-understand instruction teaches you to write in machine language. Upon completion of this course, you will be proficient in computer technology. Complete with 126 page lesson manual, instructions and experiments.



Amateur Radio Receiver Kit Model AR-2N6K

\$34.95

FM Receiver Kit and training course. Ideal for beginners. Easy to build and learn about amateur radio.

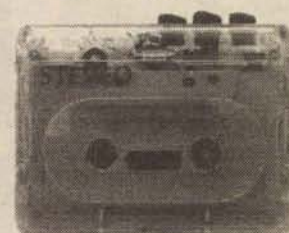
- Covers both 2 meter (144-148MHz) and 6 meter (50-54MHz) FM.
- Dual conversion superheterodyne
- Loud speaker output
- Squelch Control
- Internal 9V battery
- Includes all parts, case, schematics, assembly and training manual.



Stereo Cassette Player Kit Model TR-18K

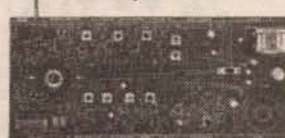
\$15.95

- Transparent Case
- Belt Clip
- High Resolution
- Includes Headphones



AM/FM-108K

\$29.95



AM/FM Radio Kit and Training Course 14 Transistors and 5 Diodes

Training course of 52 pages is divided into 9 lessons; Audio Amplifier, AM Detector, AM IF, AM Amplifier, AM Mixer & Oscillator, FM Detector, 1st FM IF, FM RF Stages. "Superheterodyne" receiver of standard AM (amplitude modulation) and FM (frequency modulated) broadcast frequencies. (PC board 11 5/8" x 5 1/4")

AM Radio Kit and Training Course 7 Transistors and 1 Diode

\$19.95

Call for a FREE 60 page catalog!

All the tools you'll need to build these kits. 25 tools contained in a heavy-duty carrying case.

\$39.95

TK-1000



M-2665K

Deluxe Full Function Digital Multimeter Kit

Extra large 1 1/4" x 2 1/2" LCD display area, 3 1/2 digit display, 34 ranges (cap., trans. test, diode test).

\$54.95



M-1005K

Digital Multimeter Kit

Low cost, 3 1/2 digit LCD, 18 ranges, transistor test, diode test, overload protection and pocket size.

\$19.95



FG-500K

100KHz Function Generator Kit

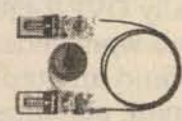
Provides sine, square or saw tooth waveforms continuously variable 1Hz to 100KHz. Amplitude adjustable to 2.5V peak to peak. Complete with all parts, PC board, schematic, deluxe case with handle and extensive assembly manual.

\$34.95



FO-30K

Fiber Optics Technology with training course



Learn the basics of fiber optics data communications while you build this exciting kit. Comes complete with all necessary components.

\$19.95

Robotic Arm Y-01

The Movit Robotic Arm is an educational kit that teaches the fundamentals of a basic robotic arm as well as your own motor skills.



\$59.95

Sound Activated Switch

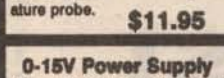
Clap and the light comes on, clap again and off it goes.



\$8.95

Temperature Adapter Kit Model K-40

This easy and fun-to-build kit converts any 2VDC range multimeter into a temperature probe.



\$11.95

Motion Detector Kit SS-50K

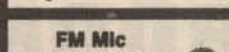
Compact and portable. Adds safety to your home & office.



\$18.95

Telephone Line Analyzer Kit Model TT-400K

A telephone line analyzer that provides fast indication of telephone line polarity, ring and line voltage levels.



\$19.95

Telephone Kit Model PT-223K

Build this high-tech see-thru plastic telephone. Learn theory on how telephones work and then proudly show off your work with the transparent phone case. Complete with all parts and manual. Neon lamps flash when the phone rings.



\$15.95

Telephone Hold Button

Put all incoming and outgoing calls on hold at the press of a button.



\$6.50

Strobe Light

Produces a bright flash via xenon flash tube. The flashing rate is adjustable.



\$8.95

0-15V Power Supply

A low-cost way to supply voltage to electronic games, etc.



\$14.95

Telephone Bug

Size of a dime yet transmits both sides of a phone conversation to any FM radio. No battery needed.



\$8.95

FM Mic

Transmit your voice on any FM radio. Range up to 100ft. Case incl.



\$9.95

Excellence in Service
UPS Shipping 48 States 5%
IL Res. add 8% Sales Tax

C&S Sales, Inc.

150 W. Carpenter Avenue
Wheeling, IL 60090



2 year warranty on all parts
and free technical support
on purchases.

GORDON WEST

Ham/Commercial Code Course

LEARNING MORSE CODE, FROM SCRATCH

6 LONG-PLAY HIGH-FIDELITY CODE CASSETTES

- ✓ Prepare for Commercial and Amateur radio Morse Code tests.
- ✓ Pass Amateur radio Novice 5 wpm code test.
- ✓ Proven "fast-code" character rates with narrated answers.



\$29⁹⁵

PLUS \$4 P&H

Checks only to:
Radio School, Inc. in
California

All instructions spoken on tape on how to prepare for both Commercial and Ham radio entry-level code tests. Many sample examinations for ham Novice license and practice tips for preparing for the Commercial code test.

This Gordon West Commercial/Amateur radio code course actually OVER-QUALIFIES you for passing the Amateur radio 5 wpm code test. Start learning code at commercial radio and amateur radio "fast-code" character rates to eliminate plateaus.

Six narrated tapes teach code copy and code test preparation for beginners with zero Morse Code background. "Gordo" makes code learning fun for ham radio, and profitable for commercial telegraph licensing.

AVAILABLE DIRECT FROM

**GORDON WEST
RADIO SCHOOL**

2414 College Drive
Costa Mesa, CA 92626

GET ACQUAINTED SPECIAL - DEALERS ONLY

DESCRAMBLERS	10 LOT	20 LOT	SPECIAL*
Stealth 1000	50.00	43.00	35.00
Stealth P-80	60.00	55.00	42.00
TVT3G	39.00	36.00	32.00
New PIO-PPLUS	60.00	57.00	43.00
M80	60.00	50.00	39.00

* Get acquainted special price is for first 100 pieces of any of the above items. This special price is good for any 10 lot plus of one item up to 100 units. Dealers have 10 weeks to purchase the hundred units. This is a sale intended for dealers only, not a retail sale.

702-895-9120

COD

VISA

MasterCard

AMERICAN EXPRESS

Write in 79 on Reader Service Card.

FREE! THE ETC. Catalog of manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

HACKERS AND EXPERIMENTERS BOOKS. Cable hackers bible volumes 1 & 2 \$44.45 each, Scanner Hackers Bible volume 1 & 2, \$34.45 each, Satellite Hackers Bible \$54.45, 8.6 megabytes of hacker software \$29.95, Black Box Bible \$34.45, Phone Phreakers Bible \$34.45, Phone Box Bible \$43.45, Superhackers Bible Volumes 1 & 2, \$34.45 each. Add \$2.00 per order for insurance. Many more plus videos! Ask for new 20 page 1996 catalog; it's free this month. TELECODE 520-782-2316.

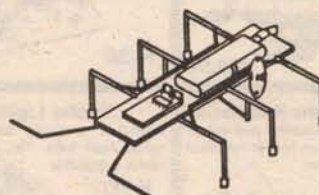
SPECTRE

CREDIT CARD BLACK BOOK: Eye-popping manual completely details the "nuts and bolts" of credit cards and the industry. Covers: Card algorithms, multiple magnetic tracks, coding techniques, decoding information, data fields, digital encoders, credit verifiers, smart cards, more! Includes plans for a card reader/writer that can copy data from a credit card and store on computer or onto other backup cards! Extract the data from your bank cards to find out your subaccount numbers and how your bank keeps track of you. Includes demo software to verify account numbers long with a discussion of every form of credit card fraud in use. **Be aware!** Only \$20! **Spectre Press**, PO Box 5112, North Muskegon, MI 49445.

WORLD'S MOST UNUSUAL Communications Books! Large selection covering Scanners, "confidential" frequency (HF/VHF) registries, wireless history, bugging, wiretapping, electronic surveillance, monitoring, etc. Big free catalog! **CRB Research**, Box 56-NV, Commack, NY 11725.

ROBOTICS

TRUE ARTIFICIAL intelligence for robots, computers. New 2hr VHS video, \$19.95. Rose, PO Box 7589, Chula Vista, CA 91912.

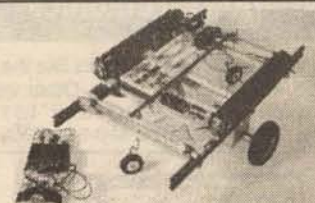


HEXWALKER™ ROBOT Kit. Basic Stamp controlled, servo driven. \$124.95 + \$5 S&H North America, \$15 S&H others. Manual alone \$9.95 + \$1 S&H. Kit w/o Stamp \$74.95. Servo \$14.95. CA add 7.75%. M&T Systems, PO Box 7816, Huntington Beach, CA 92615. Tel. 714-969-3166, Fax 714-969-3167, E-Mail mandtsys@ix.netcom.com



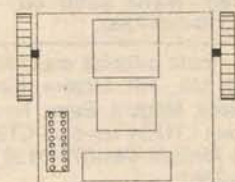
THE ELECTRONIC EXPERIMENTER'S JOURNAL. It's part catalog, part magazine, part data book. Kits, plans, schematics, computers, parts, articles, ideas, and application notes. Get your **FREE** copy today by calling 1-800-423-4499 or FAX to 513-531-4455. Debco Electronics, 4025 Edwards Rd., Cincinnati, OH 45209.

THE MAGAZINE for robot builders: The Robotics Practitioner. Build better robots with practical ideas from articles written by robot builders. Send today for a free brochure. Footfalls, Ltd., 483 S. Kirkwood Road #130N, Kirkwood, MO 63122. E-Mail: TRP@Footfalls.com



OPIE™ THE mobile robot has been professionally designed by educators for use by College and High School Technology Teachers. OPIE-A comes with a 65 page lab manual and corresponds to a 30 hour unit in analog control. OPIE-D comes with a 110 page manual and provides a 50 hour unit in digital electronics and computer software programming. Prices: OPIE-A \$275, OPIE-D \$345. For more information contact: Precision Micro Dynamics. Tel 604-472-7249, FAX 604-472-1830, <http://www.islandnet.com/~pmd>

UNDERWATER SALVAGE ROBOT with dredge, on-board video link and remote control system. Three powerful steering motors for tight maneuvering. Great for lake prospecting. Find treasure. Learn robotic technology. Plans \$20 to: PAR, 417 Associated Rd., A-313, Brea, CA 92621.



NEURAL NETWORKS & ROBOTICS Neural Lab w/basic source code library \$29.95. Learn to solve problems such as speech recognition, stock forecasting, pattern recognition and many more. Neural Lab 'C' source code \$29.95. Speech recognition, pattern recognition, financial market prediction, and many more working examples included! Max Robot Base \$129.95. Mobile base for home brew robotics. Postage included in prices. MO residents add 6% sales tax. Zagros Software, PO Box 460342, St. Louis, MO 63146-7342, 314-768-1328, zagros@mo.net

RA Enterprises... A real surplus store!

ORDER HOT LINE

8:00 am — 4:30 pm PST

Monday — Friday

1-800-801-0230

When it comes to bargains, this is the place!

Digitek DT-3800 \$19 each Full Range DMM



- 5DCV ranges $\pm 0.5\%$
- 5 ACV ranges $\pm 0.8\%$
- 7 DCA ranges $\pm 0.5\%$
- 7 ACA ranges $\pm 1\%$
- 6 Ohms ranges $\pm 0.8\%$

- Diode & Transistor Tester
- Continuity Buzzer
- Leads, manual and battery

New — In the box! (RA00039)

Ear Phone

\$5 each or 10 for \$45 (RA00090)

Good for Walkman and any audio equipment.

DTC

CONTROLLER CARDS

NEW - In Box - 30-day Warranty!

Order 20+ and get a 25% discount

Description	Interface	Description	Price
5150XL	MFM	8-bit Hard Drive Only	\$15
5160X	RLL	8-bit Hard Drive Only	\$10
5187	RLL	16-bit 2:1 Hard Drive Only	\$10
5280	MFM	16-bit 2:1 Hard Drive/Floppy	\$15
5287	RLL	16-bit 2:1 Hard Drive/Floppy	\$15
7180	MFM	16-bit 1:1 Hard Drive Only	\$15
7187	RLL	16-bit 1:1 Hard Drive Only	\$10
7287	RLL	16-bit 1:1 Hard Drive/Floppy	\$15

Dashboard for Windows (RA00123)

Version 2.0 \$2 each

Previously installed disks.

Return to Zork CD-ROM (RA00093)

For Windows

ONLY \$10 each

Mavis Beacon Version 2.0 (RA00084)

ONLY \$10 each

Teaches typing for DOS

New IDE Controller Cards (RA00040)

ONLY \$5 each or 10 for \$35

DT-3767

SPECIAL EXTRA DISCOUNT ITEMS

- DAP Plastic Mender — Repairs tears and cracks in vinyl or canvas upholstery and inflatables. It's permanent, flexible and waterproof. (RA00077)

Box of 12 for ONLY \$20

- Epoxy Patch Kits — Dexter Hysol #608 clear, 1.40 ounce resin, 1.40 ounce hardener. Sets in only 5min. (RA00050)

\$3 each or Box of 10 for ONLY \$22.50

HP Net Server Assistant

\$12.50 each, 20+ \$10.00 ea. (RA00049)

You've got to get this one while they last Ver. 1.0.

HURRY
Get yours.
Supplies limited!



HP 7550A 8-pen Automatic Sheet Feed Plotter (RA00066)

Tested good! Serial and HP-IB interface

- High throughput
- Ideal for high volume, shared environments
- Uses drafting media and pens
- Requires minimum operator supervision
- Accepts A3/B- and A4/A-size paper
- No manual and no exit tray

**ONLY
\$195**

High-Grade Shielded Cables

- 6 foot parallel printer cable. 45° angle DB25, ground wire on centronics connector. \$5 each (RA00033)
- 25 foot DB25F to DB25M with 25 pins connected straight through. \$8 each (RA00031).
- 100 foot. DB25F to DB25M with all 25 pins connected straight through. \$15 each (RA00029)



IBM MFM Controller Card

\$12.50 each or 10 for \$100 (RA00075)

16-bit, 2:1 interleave hard and floppy controller

HP LJ4 Envelope Feeder (RA00041)

ONLY \$75 For Laser Jet 4 only.

DOS 6.0

1.44 Diskettes

NEW! Still in the box with the manual.

ONLY \$19

(RA00067)

Norelco Heat Lamp

Only \$10 each or 5 for \$40

Fits in any regular light socket and can run off AC or DC. (RA00075)

SCSI Terminator to Male db 25

\$3.95 each Or 10 for \$32.50

(RA00117)



Zircon Electra Level

ONLY \$10

This is a new electronic water level that you can use for any project you have

that you need to make sure it's level — even around corners. Ideal for business or at home. (RA00065)

QUICKEN — Special Edition For Windows

ONLY \$15 each

(RA00082)

BLOW-OUT SALE Laser Labels

510 2-3/4" x 1" Clear Matte Labels

- \$2.00 each or 12 pkgs \$20 (RA00054)

210 4" x 3-1/3" Shipping Labels

- \$2.00 each or 12 pkgs \$20 (RA00055)

Florescent Lamps 18 watt

18w puts out the same as a standard 75w bulb.

ONLY \$7 each or 10 for \$65 (RA00115)

Hubbell Twist Lock Electrical Connector

(RA00086)

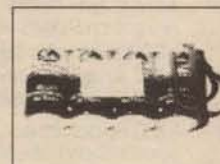
ONLY \$2.50 each or 10 for \$20

DOS 5.0 — 1.44 Diskettes

NEW! Still in the box with the manual.

ONLY \$19

(RA00072)



GATES

Battery Pack

**ONLY \$5 each
or 10 for \$39**

(RA00068)

Great buy on a battery pack. 2 volt, 2.5AH, lead acid gel-type. It can be split into singel cell configuration.

NEW CATALOG!

RA Enterprises will have a complete catalog by February 1996. Get your name on our mailing list early. If you've ordered from us before, you are automatically on the list.

Special ORDER HOT LINE ONLY

1-800-801-0230

Order Line Hours: 8:00 am — 4:30 pm PST

Monday through Friday

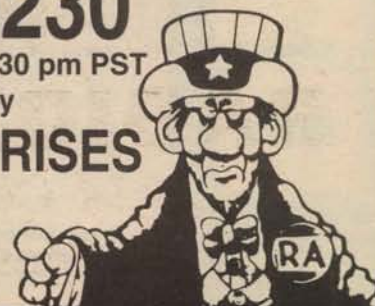
RA ENTERPRISES

2260 De La Cruz Blvd.

Santa Clara, CA 95050

Tel: 408-986-8286

Fax: 408-986-1009



We Accept Discover Card, VISA, Mastercard, Check, Money Order.



This Advertisement is our catalog. All items subject to prior sale. Minimum order \$10.00 plus shipping and handling charges. All orders shipped FOB Santa Clara, CA via UPS ONLY. Ground shipping unless otherwise requested. All items are sold as-is, and no warranty is expressed or implied unless otherwise noted.

**We always
have great
in-store
specials.
Drop on by!**

The dealers listed below carry the latest issue of Nuts & Volts, for your convenience.

ALABAMA

Little Professors Book Center
2717 18th Street
Birmingham 35209
RT Systems Amateur Radio Supply
8207 Stephanie Drive
Huntsville 35802

ARIZONA

Batteries, Batteries
3415 West Glendale Avenue #4
Phoenix 85051

1829 East Southern Avenue
Tempe 85282

6245 East Bell Road
Scottsdale 85254

MJ Sales, Inc.
1842 West Grant Road
Tucson 85745

Wholesale Satellite
706 E. Fort Lowell Road
Tucson 85719

CALIFORNIA

Abletronics
9155 Archibald Ave Unit E
Cucamonga 91730

Aerogen Electronics
7411 Garden Grove Boulevard
Garden Grove 92641

All Electronics
905 S. Vermont Avenue
Los Angeles 90006

14928 Oxnard Street
Van Nuys 91411

Alltronics
2300-D Zanker Road
San Jose 95131

California Compu-Books
3805 Ocean View Boulevard
Montrose 91020

Darrell Electronics
4910 Santa Anita Avenue
El Monte 91731

Del Amo Book & News
163 Del Amo Fashion Center
Torrance 90503

Ford Electronics
8431 Commonwealth Avenue
Buena Park 90621

Harding Way News
113 W. Harding Way
Stockton 95204

Hi-Fi Doctor
1814 E. Ball Road
Anaheim 92805

HSC Electronic Supply
4837 Amber Lane
Sacramento 95841

3500 Ryder Street
Santa Clara 95051
6819 Redwood Drive
Cotati 94931

JK Electronics
6395 Westminster Avenue
Westminster 92683

Opamp Technical Books
1033 N. Sycamore Avenue
Los Angeles 90038

Pace Electronics
369 Hampshire Road
Thousand Oaks 91361

Sav-On Electronics
13225 Harbor Boulevard
Garden Grove 92643

Servo Track
535 Salmar Avenue Suite D
Campbell 95008

Survival Books & Equipment
11106 Magnolia Boulevard
North Hollywood 91601

The Radio Place
5675-A Power Inn Road
Sacramento 95824

Tower Books
1280 E. Willow Pass Road
Concord 94520

630 San Antonio Road
Mountain View 94040

2727 El Camino Real
San Mateo 94403

Tower Records/Video
5611 Blackstone
Fresno 93710

14570 Ventura Blvd.
Sherman Oaks 91403
Valencia Newsstand
23164 West Valencia Boulevard
Valencia 91355

Video Electronics
3829 University Avenue
San Diego 92105

CANADA

Com-West Radio Systems Ltd.
48 East 69th Avenue
Vancouver, BC V5X 4K6

COLORADO

International Tesla Society
2220 E. Bijou Street
Colorado Springs 80909

T H Electronics
216 Commerce Dr., Unit 2
Fort Collins 80524

Western Test Systems
530 Compton #C
Broomfield 80020

CONNECTICUT

Archway News
64 Bank Street
New Milford 06776

Derric Electronics
1660 Whitney Avenue
Hamden 06517

FLORIDA

Clarks Out of Town News
303 S. Andrews Avenue
Fort Lauderdale 33301

Mike's Electronic Distributing Co.
1001 NW 52 Street
Fort Lauderdale 33309

Skycraft Parts & Surplus, Inc.
2245 W. Fairbanks
Winter Park 32789

Sunny's At Sunset
2260 Sunset Strip
Sunrise 33322

What's Their Name Computers
Midway Flea Market, US41
Bradenton 34203

IDAH0

Electrocom
846 6th Avenue South, Suite D
Payette 83661

Hi-Tech Surplus
605 East 44th Street
Boise 83714

The Current Source
5159 Glenwood
Boise 83714

ILLINOIS

City Newsstand
4018 N. Cicero
Chicago 60641

Pick's Electronics
Lewis Park Mall
Carbondale 62901

Tower Records/Video
2301 N. Clark Street #200
Chicago 60614

Tower Records/Video/Books
383 W. Army Trail Road
Bloomington 60108

INDIANA

Harbourtown Sales
21040 Hague Road, I-O
Noblesville 46060

KANSAS

Lloyd's Radio & Electronic, Inc.
220 W. Harry Street
Wichita 67213

Pioneer Technologies
1644 Elgin Drive
Salina 67401

KENTUCKY

K-Soft Systems
514 Steele Street
Frankfort 40607

LOUISIANA

Lakeside News
3323 Severn Avenue
Metairie 70002

MARYLAND

Silicon Valley Electronics
2014-A Industrial Drive
Annapolis 21401

Tower Records/Video
1601 Rockville Pike #210
Rockville 20852

MICHIGAN

Family Electronics
111 East Superior Street
Alma 48801

Little Professors Book Center
22174 Michigan Avenue
Dearborn 48124

Purchase Radio Supply, Inc.
327 East Hoover Avenue
Ann Arbor 48104

Radio Shack
1332 U.S. Hwy 41 West
Ishpeming 49849

Tower Records
1214 S. University Avenue
Ann Arbor 48104

MINNESOTA

Radio City, Inc.
2633 County Road 1
Mounds View 55112

MISSOURI

Accurate Instruments
11201 East 24 Highway
Independence 64054

Electronics Exchange
8644 St. Charles Rock Road
St. Louis 63114

Stewart & Associates
204 Sonderen Street
O'Fallon 63366

NEBRASKA

Ladd Electronics Co.
111 N. 41st Street
Omaha 68131

NEVADA

Amateur Electronic Supply
1072 North Rancho Drive
Las Vegas 89106

Less Buster's Electronics
2930 N. Las Vegas Blvd. VSTG-22
North Las Vegas 89030

Tower Records/Video
4580 W. Sahara Avenue
Las Vegas 89102

NEW JERSEY

JR Tech Systems
1309 Highway 71
Belmar 07719

NEW YORK

All Phase Video Security, Inc.
70 Caln Drive
Brentwood 11717

Ham Central
3 Neptune Road
Poughkeepsie 12601

Hirsch Sales Co.
219 California Drive
Amherst 14221

Tony's Equipment
10065 Morley Road
North Collins 14111

OHIO

Compustuff
2751 Medina Road
Medina 44258

Digital One
7601 Mentor Avenue
Mentor 44060

Footsteps
4925 Jackman Road Store #58
Toledo 43613

Hosfelt Electronics, Inc.
2700 Sunset Boulevard
Steubenville 43952

Keyways, Inc.
611 S. Main Street
Miamisburg 45342

Leo's Book Shop
330 North Superior Street
Toledo 43604

Powermaxx, Inc.

1587 U.S. Route 68 North
Xenia 45385

OREGON

News & Smokes
2295 W. Main Street
Medford 97501

News & Smokes #8
259-C Barnett Road
Medford 97501

Norvac Electronics
7940 SW Nimbus Ave. Bldg. 8
Beaverton 97005

960 Conger
Eugene 97402

1545 N. Commercial NE
Salem 97303

Powell's Technical Bookstore
33 NW Park
Portland 97209

Tower Books
1307 NE 102nd Avenue
Portland 97220

PENNSYLVANIA

Lehman Scientific
2997-F Cape Horn Road
Red Lion 17356

Penn Electronics
2310 A Walnut Street
Harrisburg 17103

Tower Books
425 South Street
Philadelphia 19147

PUERTO RICO

Marval Security Equipment
Calle 6 #13, Ext. San Agustin
Rio Piedras 00926

TEXAS

Tanner Electronics
1301 W. Beltline #105
Carrollton 75006

The Communication Source
2713 Galleria Drive
Arlington 76011

UTAH

Omega Electronics
1500 North 150 West
Provo 84604

VIRGINIA

Electronic Equipment Bank
323 Mill Street NE
Vienna 22180

Riley's Distributing
1045 Edom Road
Harrisonburg 22801

Satellite Headquarters
7920 Timberlake Road
Lynchburg 24502

Tower Records/Video/Books
4110 W. Ox Road #12124
Fairfax 22033

WASHINGTON

A-B-C Communications, Inc.
17541 15th Avenue NE
Seattle 98155

Amateur Radio Supply Co.
5963 Corson Avenue S. #140
Seattle 98108

Supertronix
18650 68th Avenue South
Kent 98032

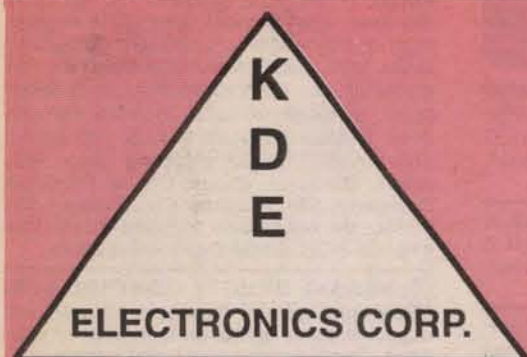
Tower Books
10635 NE 8th Street
Bellevue 98004

20 Mercer Street
Seattle 98109

WISCONSIN

Amateur Electronic Supply, Inc.
5710 W. Good Hope Road
Milwaukee 53223

News & Hobby Center
4758 Packard Avenue
Cudahy 53110



- PERSONALIZED ASSISTANCE •
- COMPETITIVE PRICING •

Please have the make and model number of your current cable box so that we could give you the best available systems in your area.

CATV SYSTEM COMBOS

SA-M-80 -COMBO:	150.00
SA-M-80-DECODER ONLY:	85.00
PIO-COMBO:	165.00
PIO-DECODER:	95.00
DIGITAL J-COMBO	150.00
DIGITAL J-DECODER	85.00
ZENITH COMBO: (RECONDITIONED)	235.00
ZENITH DECODER: (RECONDITIONED)	170.00
OAK COMBO	135.00
OAK DECODER	70.00

SOME BRANDS NOT LISTED

(ALL COMBOS CONSIST OF TUNER, REMOTE, AND DECODER + PATCH CORD)

• NO ILLINOIS SALES:

TECHNICAL HELP: 1-708-889-0281



CATV 1 PC. SYSTEMS

NOVA-5700:	245.00
NOVA-5800:	245.00
NOVA-5600:	245.00
8580:	250.00
8590:	CALL
8600:	CALL

(1 PC. UNITS CONSIST OF A CONVERTER WITH BUILT IN DESCRAMBLER & REMOTE)

FILTERS

CHANNELS #2 THRU #23	20.00
----------------------	-------

CONVERTERS: (PARENTAL LOCKOUT)

PANASONIC	89.00
NOVA CENTURY:	79.00
VOL - CONTL:	105.00
REMOTE A/B SWITCH:	35.00
PATCH CORDS:	1.25

• ANY COMBO WITH PANASONIC CONVERTER ADD 10.00 PER UNIT

* 30 DAY MONEY BACK GUARANTEE

* 6 MONTH WARRANTY

PRICES EFFECTIVE AS OF APRIL 95

PRICES SUBJECT TO CHANGE WITHOUT NOTICE!

P.O. BOX 1494

ADDISON, IL 60101

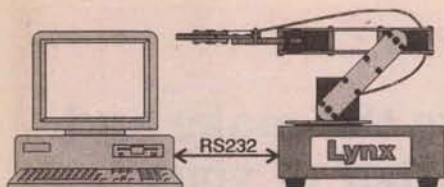
INFO 1-708-889-0281

FAX 1-708-889-0283

HOURS - Mon. thru Fri. 9-6, Sat. 10-2

TOLL FREE ORDER LINE -

1-800-361-4586



ROBOTIC ARM Kit, five axis with gripper. Control with any serial port. Very accurate and repeatable. Level 1 kit is \$60 uses RC servos you provide. Includes all hardware, structural components, software and illustrated assembly manual with information on MiniSSC controller. Level 2 kit is \$180, includes level 1 plus servos and controller. Add \$7.50 S&H USA, \$15 all others. Technical Service and Solutions, 104

Partridge Rd., Pekin, IL 61554-1403, 309-382-1254. www.lynxmotion.com

SERVO COMPONENTS: Litton JDH-2250-EH, 24V PM DC motor with 1000 count optical encoder, NEMA C23 \$60. Drivers: Copley 210 with MB2, $\pm 10A$ @ 75V: \$100 Copley 201, MB1, $\pm 5A$ @ 45V: \$75. Semix RD-022, Mosfet stepper drivers, 1.4A/phase \$60. Complete specs on request, 510-530-5992.

NEW! HANDYBOARD from MIT. Motorola 68HC11, 16x2 LCD, motor ports, A/D, infrared I/O, more! Program in Interactive-C. Free programming software! Kit is only \$185. Check out <http://www.infinet.com/~cwtech/> or call 1-800-547-7479. CW Technology, 7328 Timbercreek Court, Reynoldsburg, OH 43068-1181.

PLANS/KITS/SCHEMATICS

VOICE CHANGER board! Fully assembled and tested! Not a kit! 16 levels of change, many applications! \$39.95 + \$4 (S&H) US funds! **PARSEC Electronics**, PO Box 34594, Phoenix, AZ 85067.

RESELL 200+ ELECTRONIC PLANS & KITS. Earn 100% profits. SASE for list & dealer info. Matco Electronic Publications, POB 509-A2, Roseville, MI 48066-0509.

BUILD IT yourself. Dog bark inhibitor, car/trailer alignment device, power antenna saver. Please send \$3 for catalog to Cintron, PO Box 0015, Roseville, MI 48066-0015.

RING-IT! Phoneline Simulator Kit. Authentic dial tone, busy signals, and 20Hz ringing. High quality audio lets you test or demonstrate high speed modems, telephones, fax machines, etc. Kit includes high quality circuit board, all electronic parts, technical manual, \$149. Custom enclosure \$34.95. Add applicable tax \$6.50 USA shipping. Visa, MC, Amex, Discover, check. Digital Products Company, 134 Windstar Cir., Folsom, CA 95630. 24 hour voice 916-985-7219, Fax 916-985-8460, E-Mail DigProd@aol.com

UNIVERSAL REMOTE CONTROL SYSTEMS infrared, RF miniature transmitters, receivers. Items for novice technician or educator. Combine your home and vehicle control automate anything. **FREE CATALOG.** Inventive Solutions, PO Box 8, Stratford, NY 13470.

S&N

The Electronics SuperStore

- Buy direct from the manufacturer
- 10 years of quality equipment & service
- The most competitive pricing in the industry
- Prompt delivery / Expert sales personnel

We now offer
a complete
line of
Programming
Equipment



NEW

"THE 95 KOPY KAT" - Program any Motorola phone - the Flip, the Micro-tac, the Ultra-Lite, the Elite, the 951C, or any installed or bag phone. Complete with cables, instructions, is battery operated for ease of use. **\$2295**

The Original "KOPY KAT" - Program any Motorola phone - the Flip, the Micro-tac, the Ultra-Lite, the Elite or any installed or bag phone. Complete with cables, instructions, and is battery operated. **\$1695**

Motorola Loader Bag System - Programs up to 94 version, includes flip cable, computer cable and transfer box. **\$650**

Nokia Software - Programs Model #'s LX11, LX12, C15, PT612 and 4000. Requires Eeprom programmer. Programs Technophone mobiles and bags, Radio Shack mobiles and bags. **\$400**

NEC Software - Will program 110, 120, 180, 181 version 1.0 and 1.5. Cable included. **\$400**
400 and 600 with cable. **\$200**

NEW

NEC Software & Cable - Model #'s P700, P701, P760, P761. **\$500**

NEW

GE, Ericsson ESN clip - Programs Model #'s G.E. CT700, Ericsson flip. **\$500**

Audiovox Check Sum Calculator - Will program all bag phones, mobiles, any handhelds with the 93C46 chip. Requires Eeprom programmer. **\$500**

If you do not have an Eeprom programmer, a cable can be purchased for \$200

Mitsubishi, Diamond-Tel Software - Will program Mitsubishi handheld Model #'s 3500, 4000, 4500 and newest 5000. Diamond-Tel handheld Model #'s 18X, 20X, 22X and newest 25X complete with cable, no phone disassembly required. **\$500**

NEW

DDI-ESN Reader Scanner - Includes all hardware and software except computer. Continuous login capabilities (not a kit). **\$2500**

OKI 900 - Programmable phone, modified & complete. **\$600**
Chip installation only. **\$350**

AT&T 3730 - Programmable phone, modified & complete. **\$600**
Chip installation only. **\$350**

(Certain shipping charges apply to certain products)

Please call your courteous service representatives for complete details at:

(954) 974-6161

S&N Cellular • 934 University Drive, Suite 152 • Coral Springs, Florida 33071

AGREEMENT FOR PURCHASING OF CELLULAR PROGRAMMING SOFTWARE AND EQUIPMENT

Purchaser agrees not to use said software and equipment for any illegal purposes. This includes line fraud, computer fraud, cellular service fraud, and any other fraudulent acts according to all federal and local laws, including rules of the FCC title #18, section 1029, and all Florida statutes. All software and equipment is sold only to qualified buyers. All software is sold for educational purposes ONLY!!!

THE ELECTRONIC EXPERIMENTER'S JOURNAL. It's part catalog, part magazine, part data book. Kits, plans, schematics, computers, parts, articles, ideas, and application notes. Get your **FREE** copy today by calling 1-800-423-4499 or FAX to 513-531-4455. Debco Electronics, 4225 Edwards Rd., Cincinnati, OH 45209.

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. Phone: 616-925-5899, 8-4 ET.

FPGA/DSP/uC development kits. Hot tips and applications to get you up and running. Send refundable \$US2 for catalog. USA and Canada only. BAL Engineering, 4634 Addax Dr., New Port Richey, FL 34653.

ELECTRONIC KITS: Caller ID w/battery backup, 150 call memory and an RS232 interface, Multistation Thermometer w/4 separate temperature stations and an RS232 Interface, Telephone Dialer, 240 number storage and an LCD display. Call Genoa Group, 1-800-772-3945.

OAK SIGMA, schematics, master files, equipment. Call 719-661-1659 for free Sigma catalog.

TURN SIGNAL REMINDER. This patented reminder keeps you from going down the road flashing, inadvertently. Just \$30 post-paid. Visa/MC. 30-day money back guarantee. Great gift for that forgetful someone. Literature available. **SILENT SAM TURN SIGNAL REMINDER**, 1627 Basil Dr., Columbus, OH 43227. **TOLL FREE 1-800-398-5605.**

REMOTE CONTROL miniature encoded transmitters and receivers infrared and RF kits and assembled boards. Free catalog. Inventive Solutions, Inc., PO Box 8, Stratford, NY 13470.

SCHEMATICS, NEWLY released to public. Inverted signal crystal controlled AM phone transmitter, matched receiver #111795 \$15, silent automotive burglar transmitter #041695 \$10, receiver decoder alarm #031095 \$10, several secret service devices. Catalog \$3, SUR-TECH, PO Box 75, Steele, AL 35987.

PCB SERVICE. Great rates! **FIRST PROTO**, 919-403-8243.

CNC - NEW LOW COST CHOPPER DRIVE. 3 AXIS motion controller is a high speed upgrade over inefficient L/R drives. Will run drill machines, small mills, small lathes and other mach. This controller will run three bipolar stepper motors in the full or half step modes. Features include all winding off, 2 amps, 20K chopper freq. works with low cost CAD/CAM program. Includes provisions for home switches and solid state relays to 20A. Kit includes PC board, all parts and demo software. Kit is \$145 + \$5 S/H. Assembled and tested \$195 + \$5 S/H. CAD/CAM/CNC/PLOT program \$15. 3 axis L/R low cost controller kit \$85. Call for stepper motors. Send US check/MO to CAMTRONICS, INC. 18230 130 PL. NE, Bothell, WA 98011-3118. Tel: 206-487-0013 after 4pm pacific.

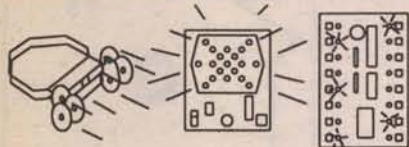
PARTY-LINE caller ID phonenumber simulator kit. Featured in Jan-Feb 1996 Electronics Now Magazine. Six direct dial extensions with caller ID and distinctive ringing. Provides authentic dial tone, busy signal, and 20Hz ringing. Use to test or demonstrate telephone devices. Kit includes high quality circuit board, all electronic parts, technical manual, \$199.95. Custom enclosure \$32.95. Add applicable tax, \$8 USA shipping. Visa, MC, Amex, Discover, check. Digital Products Company, 134 Windstar Cir., Folsom, CA 95630. 24 hour voice 916-985-7219, Fax 916-985-8460, E-Mail DigProd@aol.com

HOW TO build a low cost differential **PROTON PRECESSION MAGNETOMETER**. Includes theory, instructions, schematics, parts list, pictures and audio cassette of mag sounds. For experienced electronic builders. Uses mostly Radio Shack parts. Postage paid \$39.95. Barnes & Associates, 24631 Via San Fernando, Mission Viejo, CA 92692.

HOBBY CATALOG: Broadcast, ham, CB transmitters, amplifiers, antennas. TV add-ons, descramblers, bugging devices, science projects, start your own radio station books and more. PAN-COM International, Box 130-V, Paradise, CA 95967.

SCHEMATIC PLANS instructions for converting gas furnace (standing pilot type) to pulse operation, saving 20-25%. Uses 555 chip plus few components. Send \$4 or SASE for further info. Harlen Pennington, 2139 Coolidge St., Lansing, MI 48906.

HARD TO FIND SERVICE LITERATURE for sale. TV, stereo, VCR, camcorder, RL-RL, CB, Sams TV/MHF/AR/CB series, test equipment, turntables, speakers, etc. SASE for list to John Crow, 626-A N. Old Corry Rd., Pensacola, FL 32506.



HOT KITS! Build microcontrolled kits: Seventeen function remote controlled robot kit \$99. Eight function mini-light show kit \$59. Twelve function electronic game kit \$79. Perfect for school projects or just learning about microcontrollers. Call or write for free info. Silicon Sound, PO Box 371694-NV, Reseda, CA 91337-1694. Phone 818-996-5073.

DIGI-CALL telephone call logger kit. Automatically records call data on 1,500 calls. Stores dialed number (tone or pulse), incoming Caller-ID, time/date, call duration, and more! Collect data then connect to your PC to retrieve, sort, and print. Export data to your spreadsheet, too. Complete kit, includes high quality circuit board, all electronic components, microprocessor, DOS software, manual, \$169.95. Custom enclosure \$32.95. Add applicable tax, \$8 USA shipping. Visa, MC, Amex, Discover, check. Digital Products Company, 134 Windstar Cir., Folsom, CA 95630. 24 hour voice 916-985-7219, Fax 916-985-8460, E-Mail DigProd@aol.com

CNC DRILL PRESS conversion plans. Convert your floor or bench drill press to CNC for under \$600 including 3 axis motion controller kit. Plans include comprehensive manual, numerous photos and detail drawings of parts. Plans cover conversion or most 8-16" drill presses. X-Y tables has 6x6 travel. XYZ axis are fully supported. Accuracy is vastly improved over manual methods. Plans are \$25 + \$5 S/H with fast service. **CAMTRONICS, INC.**, 18230 130th Pl. NE, Bothell, WA 98011-3118. Call 206-487-0013 after 4pm Pacific.

100% POLICE RADAR JAMMERS ACTIVE JAMMER costs only \$20 to build. **1-1/2 MILE RANGE.** Sells for over \$285. **Easy 20-minute assembly, COMPLETE SCHEMATIC + PARTS LIST, \$5. Mailed today!** **BRINKER ENGINEERING LABS**, Suite 120-A, Box 348, Ellaville, GA 31806-0348.

FREE IBM based DTMF decoding program and schematic VIA the Internet. Send E-Mail address to PDRUNEN@AOL.COM Request by mail, send check for \$6 to Concept Technology, 8700 Turkey Bluff Rd., Navarre, FL 32566.

ATTENTION DEALERS

BUY DIRECT FROM THE WHOLESALER

GET THE BEST PRICES AND SERVICE

ALL UNITS ARE IN STOCK FOR IMMEDIATE SHIPMENT

DECODERS

	QTY 10	QTY 20	QTY 50+
STEALTH-1000-P.....	\$48	\$45	CALL
TVT-3 GOLD	\$41	\$38	CALL
TNT-3	\$45	\$42	CALL
STEALTH 80-P.....	\$54	\$49	CALL
M-80.....	\$64	\$58	CALL
PIO+.....	\$68	\$58	CALL

NOVAVISIONS

	QTY 10	QTY 20	QTY 50+
NV-5600	\$249	\$239	CALL
NV-5700	\$229	\$219	CALL
NV-5800	\$229	\$219	CALL
NV-5750	\$319	\$299	CALL

BOSS COMBOS

	QTY 10	QTY 20	QTY 50+
BOSS 1.....	\$225	\$205	CALL
BOSS 2.....	\$235	\$215	CALL
BOSS 3.....	\$245	\$225	CALL

NEW CONVERTERS

	QTY 10	QTY 20	QTY 50+
CENTURY CT-3000 ...	\$64	\$60	CALL
SA-8511.....	\$75	\$65	CALL

REFURBISHED CONVERTERS REGAL • SA • PANASONIC

CALL FOR THIS MONTH'S SPECIALS

1-800-808-3356

DIRECT CABLE SUPPLY

Rt. 6 Plaza Mall #290, Honesdale, PA 18431. 30 day money back guarantee. All shipping and handling at customers expense. Anyone implying theft of cable service will be denied sale, NO PA SALES.

THE SOLDERLESS BREADBOX

by Donald Wilcher

Playing Around with Potentiometers

Potentiometers play an important role in the field of electronics. These three-terminal, sliding contact or rotary devices allow lights to be dimmed, sound to increase/decrease, and speed settings of mechanical machines to be adjusted. Although potentiometers are simple devices, they can be used in a variety of electronic and science projects.

To understand potentiometers doesn't require a lot of knowledge in math or mechanical engineering. Basically, a good background in simple DC electrical circuits is all that is required in comprehending voltage divider networks, Wheatstone Bridges, and null voltage measurements as they relate to potentiometer applications.

One of the most important roles for a potentiometer in a circuit application is user input interface. With potentiometers, the user of the device has input control of the unit's function. This control can either be a sliding contact or wiper motion of the product's feature.

The paragraphs to follow will investigate the function and application of potentiometers. Several circuit examples will illustrate how to apply the potentiometer in electronic simulators and user input devices. To get started on this discussion of potentiometers, let's look at the physical make-up of the device.

Description of a Potentiometer

Basically, a potentiometer is an electrical variable transducer whose resistance value can be changed by moving a sliding contact or wiper along its resistive element. Figure 1 shows a pictorial diagram along with its schematic symbol of a potentiometer. As seen in the diagram, three terminals connect the potentiometer to the outside world. All three terminals are located on the cylindrical body of the potentiometer. Two of the terminals are tied to the resistive element inside of the device, and the third terminal is coupled to the mechanical wiper or sliding contact. The resistance value decreases or increases depending on the location of the wiper on the winding coil. Rotating or sliding the contacts will change the value of resistance for the potentiometer. In the real world, the resistive element is circular and spans an angle of about 300 degrees.

Potentiometers, like active components (e.g., transistors, diodes, and ICs), have some important characteristics that should be understood by the hobbyist or experimenter. The two most important electrical characteristics for the potentiometer are linearity and resolution.

Linearity of a potentiometer is the mechanical movement of the wiper or sliding contact that produces a given change in resistance no matter where the wiper or sliding contact happens to be on the resistive element. In other words, the resistance of the element is evenly distributed along the length of the element. The precise degree of linearity of a potentiometer is very important when it comes to selectivity or adjustment of a device or system; for example, the volume control of a radio. Selectivity of the sound level and how to adjust or maintain that level is quite important for the listener of the radio.

Resolution of a potentiometer is the minimum

possible resistance variation expressed as a percentage of the total resistance. The formula used to calculate this value is:

$$\text{Resolution} = \frac{\text{Resistance per turn}}{\text{Pot Resistance Value}}$$

To see how this formula works, let's take the following example: A potentiometer's resistance value is 500 ohms with a 200 turn resistive element winding. Its resistance per turn or "rpt" would be calculated as

$$\text{rpt} = \frac{\text{Pot Resistance Value}}{\text{No. of turns}}$$

Making the appropriate substitutions into the equation, rpt equals

$$\text{rpt} = \frac{500 \text{ ohms}}{200 \text{ turns}}$$

Resolution for this example equates to:

$$\text{Resolution} = \frac{2.5}{500 \text{ ohms}}$$

$$\text{Resolution} = 0.5\%$$

Electronics parts catalogs will have information on linearity and resolution of potentiometers. If not, using these two simple formulas will allow you to evaluate the characteristics of your potentiometer quite easily. One final note about potentiometers is the number of turns of their resistive element will either classify it as either a single-turn or multi-turn potentiometer. More turns will definitely make it a multi-turn device, and less turns puts it into the single-turn potentiometer category.

Resolution is guaranteed with multi-turn pots, as well as linearity. So, depending on the application, single-turn devices might serve well. But if fine adjustments and control are desired, then use a multi-turn potentiometer instead.

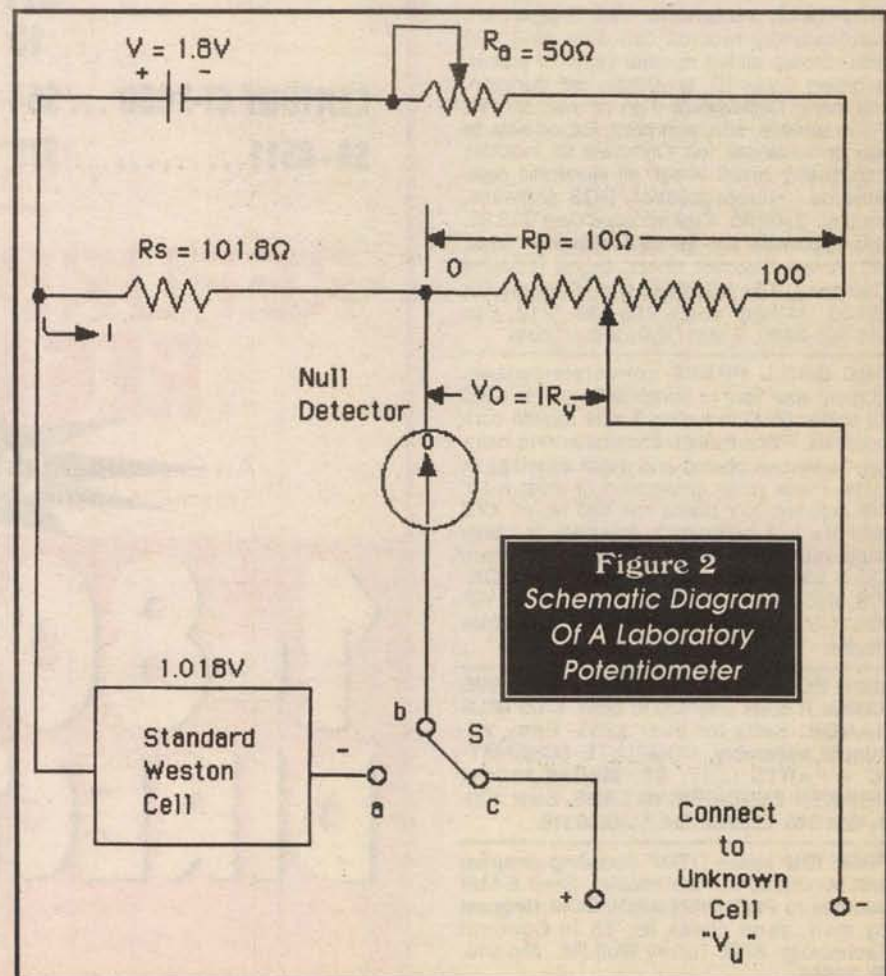
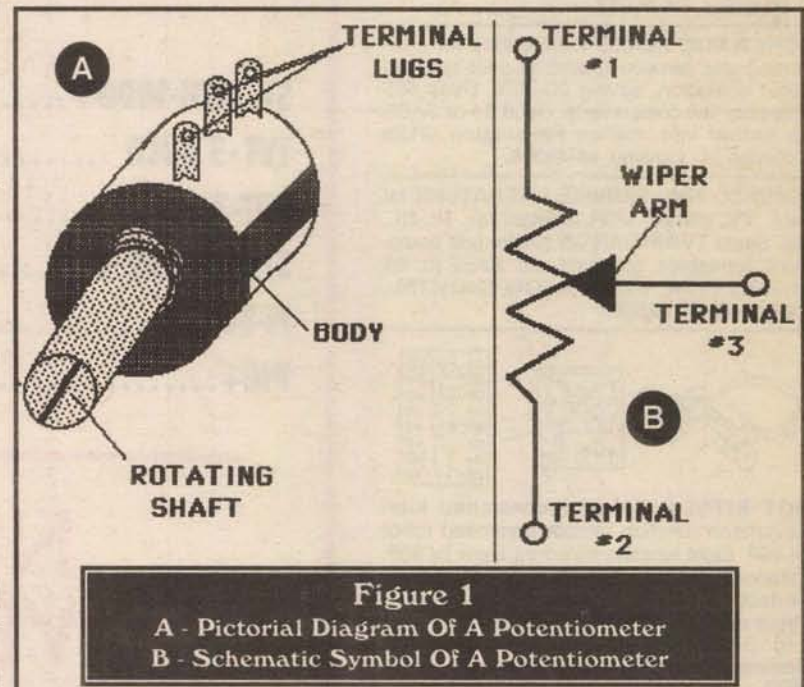
Now that the basic characteristics of potentiometers have been reviewed, let's take a look at the science behind a potentiometer.

The Laboratory Potentiometer

Back in the days of classical physics, scientific labs had a device which could measure

unknown voltages with great precision. The standard laboratory potentiometer was a classical measurement device of its time. It combined an adjustable voltage source with a sensitive null detector in a single instrument.

Figure 2 shows the schematic diagram for a laboratory potentiometer. The unit measures voltage by the null comparison technique. The null comparison voltage method detects the difference between two voltage sources.



THE SOLDERLESS BREADBOX

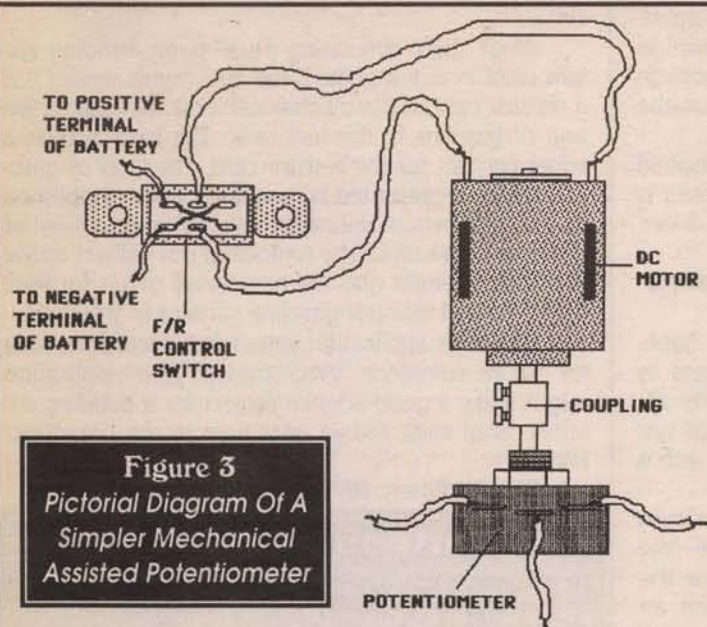


Figure 3
Pictorial Diagram Of A
Simpler Mechanical
Assisted Potentiometer

construct a precision scientific instrument. Let's take a look at other devices that the potentiometer can be used for in scientific and engineering applications.

Experimental Circuits and Projects

The following paragraphs will illustrate applications for the potentiometer in science and engineering. The method used to convey these projects is by "Mechatronics." Mechatronics is a new buzz word for the integration of electronics and mechanics. Sensors, motion controllers, and integrated circuits are examples of mechatronics. If a product is developed using electrical/electronic and mechanical processes, or incorporates those characteristics into its operation, then it's a mechatronics candidate. To understand this concept further, read the latest issue of *Machine Design Magazine*. The first project to investigate is a Motorized Assisted Potentiometer.

Motorized Assisted Potentiometer

This project will allow the use of a potentiometer-controlled circuit to be operated via remote control. Figure 3 shows a pictorial diagram for building a motorized assisted potentiometer. As one can see, to construct such a device is quite simple. The key element in accomplishing this function is the method of coupling the motor to the potentiometer.

The easiest way to attach the two devices together is by taping or gluing. The mechanical method of joining the potentiometer to the motor is by using a coupler. I used a small wire clip with a suction cup for hanging Christmas lights taped to a "ROBOTIX" motor for my mechanical coupler. The suction cup will then stick to the control knob of the 50K ohm pot mounted inside a 300-In-1 Radio Shack Electronics Lab Kit. The construction of this mechanical coupler is shown in Figure 4A.

To control the motorized device requires a F/R (Forward/Reverse) switch and a power supply. Figure 4B shows a wiring diagram for such a circuit. This remote switching feature

lar to the potentiometer. Therefore, what is measured at the output terminals would be the amount of displacement related to the vibratory nature of the source producing it.

The motorized assisted potentiometer could be used to simulate such a sensor. By moving the motor in a forward or reverse direction, the potentiometer is being displaced by some value "x" in proportion to the motor movement. To make this simulated sensor useful, accelerometers will be discussed.

An Accelerometer Demo

An accelerometer is a sensor used to detect the acceleration of a moving object. Basically, the diagram shown in Figure 5 provides a clear and simple example of how these sensors are designed and constructed.

Accelerometers can be used to trigger passenger airbags, to detect and control engine knock, and to record acceleration variations in moving objects. The unit of measurement for the acceleration is m/sec^2 (meters-per squared seconds) or ft/sec^2 (feet-per squared seconds).

With the development of micromachining technology, accelerometer sensors are being packaged in the size of ICs.

Table 1 shows a list of applications for accelerometers. In this table, you will notice the "g" after each number. The letter "g" refers to gravity in which acceleration was based on in terms of a free falling object.

In the metric system, an object will free fall at a rate of $9.8 m/sec^2$, and in English units $32.2 ft/sec^2$.

As stated earlier, the motorized assisted potentiometer can be used to simulate an accelerometer sensor.

Figure 6 shows a simple circuit for producing the

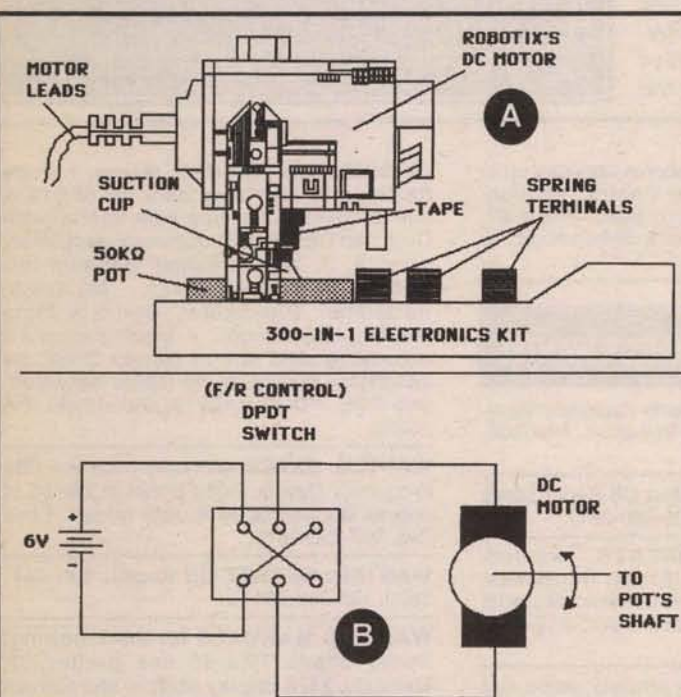


Figure 4
A - Mechanical Assist Potentiometer Using 300-In-1 Kit
And ROBOTIX DC Motor
B - Schematic Circuit For F/R Control Of A DC Motor

An adjustable reference voltage is in opposition to an unknown voltage. The reference voltage is adjusted in small increments to make it equal to the unknown voltage source. This method of measurement is the heart of the laboratory potentiometer.

The laboratory pot uses a Weston Cell as the voltage reference for the equipment. The circuit works by using a single slide wire potentiometer for its full scale value of voltage measurement. The switch labeled "S" is for calibration of the potentiometer. Move the contacts from bc to ba and adjust resistor "Ra" until the null detector meter reads zero. This reading is supported by the 1.018 volt Weston Cell potential.

The 1.018 voltage value is related to the $I_x R$ drop across the 101.8 ohm resistor. The current flowing through this resistor is 10 mA (milliamperes). To measure an unknown voltage, switch "S" is set to close contacts bc, and the precision divider consisting of the 10-ohm potentiometer is then varied until $I_x R_v$ equals the unknown voltage indicated by the null detector meter.

This circuit is a good example to illustrate the basic concepts of a potentiometer's linearity and resolution characteristics, and how they can be used to

will allow the potentiometer to vary its resistance depending on the location of the motor attached to it. With this motorized unit available, let's look at simulating a seismic sensor.

An Experimental Seismic Sensor

A good example of a potentiometer used in detecting motion is a seismic sensor. A seismic sensor or instrument uses a voltage divider pot for sensing the relative displacement between the frame and the seismic mass. Figure 5 shows a sectional view of such a sensor.

To provide the damping for the system, the case of the instrument might be filled with viscous liquid which interfaces with the frame and the mass. The vibration or motion of the vibratory source will cause the mass to move a direction perpendicular

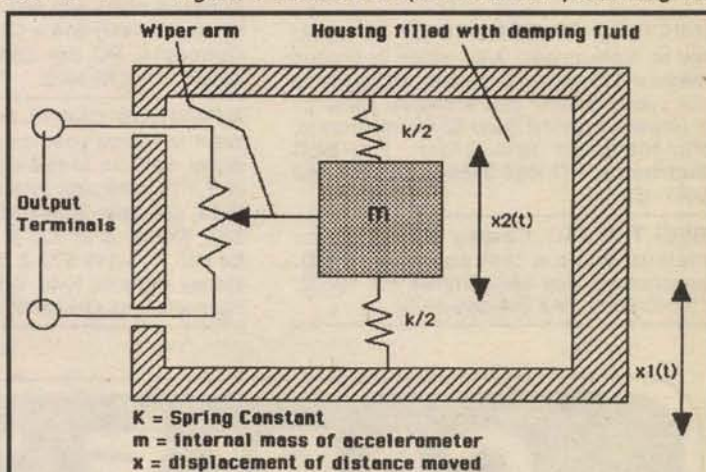


Figure 5 - Cross Section Of An Accelerometer

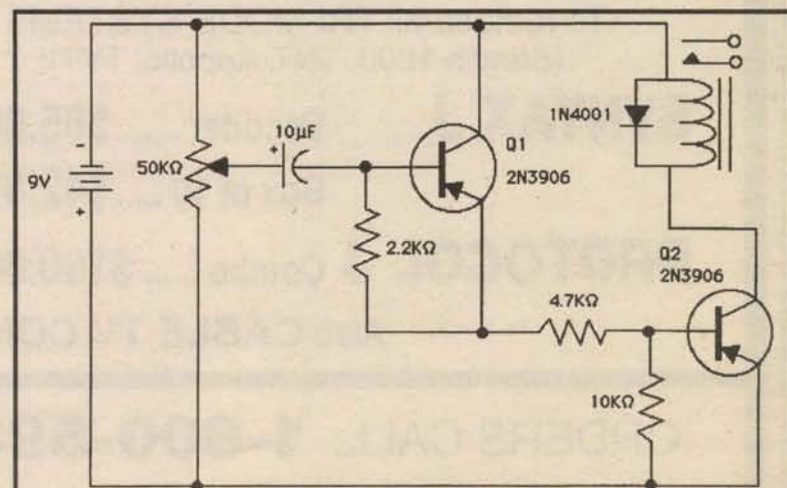


Figure 6 - An Accelerometer Simulator Circuit

THE SOLDERLESS BREADBOX

Application	Range
Knock-control	1... 10g
Passenger Protection	
Airbag, belt tightener	50g
Rollover bar	4g
Seatbelt Retention	0.4g
Antilock Brake System	0.8...1.2g
Ride Control	
Body	1g
Axle	10g
Source: <i>Automotive Handbook, Bosch, 3rd ed., 1993</i>	

on, it drives Q2 on as well. The relay, at this point, turns on driving the electrical or electromechanical load wired to its contacts. By measuring the voltage across the potentiometer, the values displayed on the meter could represent "g" values of the sensor.

This circuit could also demonstrate an overspeed indicator system, as well. If a speed-to-not-exceed is desired, an alarm could be tripped alerting the driver.

Further Thoughts and Experimentations

The potentiometer applications discussed, hopefully, have shown the potentiometer's usefulness as an input control device. The projects and circuits discussed should have illustrated the importance of system functionality and a means of controlling it with a rotary or sliding contact device.

Some additional projects to explore on your own using the information provided are to tie the accelerometer system to a computer. Every time the relay contacts close, the computer should print an alarm status on its screen.

Another circuit to explore the motorized assisted potentiometer is with a Wheatstone Bridge. Breadboard the bridge network using the motorized unit as the null detector adjustment element of the

circuit.

What about simulating a fuel pump sending system used in automobiles? The fuel pump sender has a resistor card and a mechanical lever for float detection of gasoline in the fuel tank. The lever acts as a wiper contact for the resistor card. The level of gasoline will be represented by a voltage value established by the float arm. A voltmeter will indicate the level of gasoline in the tank. The motorized pot will act as the fuel pump sender and the associated circuit for level detection will monitor gasoline content in the tank.

Whatever application you invent, record the idea for future reference. Who knows, your application might make a good science project for a budding scientist. Enuf said, see ya next time in the breadbox! NV

E-Mail address: t6790dw@infoctr.chrysler.com

Table 1
*Automotive Applications
And Their Acceleration Values*

simulator. By adjusting the 50K-ohm pot via the motorized unit, the 10-microfarad capacitor begins to charge. At the appropriate negative voltage level, transistor Q1 turns on. With this component switched

References

- *Automotive Handbook*, Bosch, 3rd ed., 1993.
- *Experimental Methods For Engineers*, 6th ed. J.P. Holman: McGraw-Hill Inc. 1994.
- *Electronics And Instrumentation For Scientists*, Malmstadt, Enke, Crouch: Benjamin/Cummings 1981.
- *Industrial Solid-State Electronics: Devices And Systems*, T.J. Maloney: Prentice Hall 1979.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-842-5953, FAX: 818-845-3613.

BASEBAND DESCRAMBLER, schematics, construction instructions, PCB pattern, layout sheet, parts list, universal model, works all systems except automatic video inversion, \$15 money order only. Ponderosa, 3624 Citadel Drive North #330, Colorado Springs, CO 80909.

MINIATURE TRANSMITTERS! All types! Low to high power! Also voice activated switches! Telephone recording switches! 16 level voice changer plus complete plans on RF power amplifiers! Send \$2 for information, refundable on first order. **PARSEC Electronics**, PO Box 34594, Phoenix, AZ 85067-4594.

FREE! THE ETC. Catalog of manuals for amateur, audio & test equipment. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.



BROADCAST FARTHER! 75-110MHz amplifier connects to stereo transmitters. Produces 2-20 watts. Requires 50-150MW drive. Complete plans with part source and antenna information only \$14 + \$2 S&H. **Progressive Concepts**, PO Box 586, Streamwood, IL 60107. 708-736-9822.

ATTENTION CAR ALARM PHREAKERS. Want to record your remote control's digital signal right out of mid-air with no disassembly? This schematic reveals all, small easy to build, get parts from Radio Shack for under \$30. Works up to 300 ft. Call 614-780-9081 for info, or send \$20 & SASE by US postal money order to Kyle Virgin, PO Box 1035, Reynoldsburg, OH 43068-7035.

ULTIMATE SPUD gun shoots potatoes up to 1,200 ft! Uses piezo-electric ignition. Inexpensive and easy to build. Plans \$7. Adams, PO Box N-681423, Schaumburg, IL 60168.

MANUALS/SCHEMATICS WANTED

WANTED: COLLINS Radio Company literature. Jim Stitzinger, 805-259-2011, FAX 805-259-3830.

WANTED: SAMS Photofact CB Radio Series books, 405-447-5689, 405-360-6817.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-842-5953, FAX: 818-845-3613.

MANUALS WANTED for amateur, audio, test equipment, TV, VCR. A.G. Tannenbaum, Box 386, Ambler, PA 19002. 215-540-8055, FAX 215-540-8327.

INFORMATION NEEDED, please. 1. Tube basing and operating data for 5FP14 & 3JP12 CRTs. 2. Person very familiar with Cushman CE50A (TG) operation, application, service. 3. Navy training manuals for: Sonarman, Torpedoman, Mineman, Radarman, Firecontrol, Gunners Mate Missiles, Quatermaster. 4. Want to know if it is possible, and how to contact DESC for information and parts. All replies answered. Info PSE, PO Box 10215, Bloomfield, PA 15232.

WANTED: EXACT information on the Rife Frequency Device. Need books or copies of original documents by R. Rife himself. Chris Zell, 607-733-5518.

WANTED: SECRET CB Books, 405-447-5689, 405-360-6817.

WANTED: MANUALS for the following: Radio Shack TRS-80 line printer VI, Memorex 2178 display station, and Qantex model 200 tape drive. CH Wexler, 863 Weeks Ave. SE, Minneapolis, MN 55414 or call 612-378-0015 after 6pm CST.

CABLE TV DECODERS

To replace all TRI-MODE SYSTEMS
(Stealth 1000, TNT, Appollo, TVT):

SYNTAX J Decoder \$65.00 EA.
Box of 10 \$42.00 EA.

PROTOCOL J Combo \$190.00 EA.

Also **CABLE TV CONVERTERS** priced from \$75 ea.

To replace all SA 8500 - 8580
(Except 8570):

STEALTH 80-P Decoder ... \$90.00 EA.
(not sold in quantities)

PROTOCOL S Combo.. \$215.00 EA.

ORDERS CALL: **1-800-598-2364** (M-F 12-6 EST)

IT IS NOT OUR INTENT TO DEFRAUD OR TO ASSIST ANY OTHER PERSON(S) AND/OR COMPANY(S) TO DEFRAUD ANY PAY TV OPERATOR(S). CUSTOMERS ARE OBLIGATED TO STRICTLY LIMIT USAGE OF PRODUCTS AND/OR INFORMATION OBTAINED FROM US TO WITHIN COMPLIANCE OF STATE AND FEDERAL LAWS.

- All Orders Shipped COD
- UPS Ground
- Shipping & Handling add \$10.00

CELLULAR SOFTWARE AND HARDWARE

COPY CAT

1	2	3	C
4	5	6	D
7	8	9	E
A	0	B	F

**COMPLETE WITH ALL
CABLES ONLY \$1695.00**
DOES ALL MOTOROLA PHONES
THROUGH '94 -
FLIPS, ELITES, BRICKS, BAGS



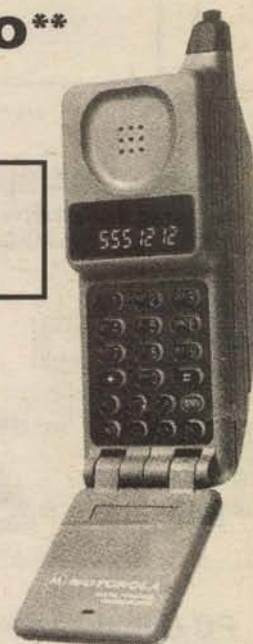
HANDHELD, BATTERY OPERATED

ESN READERS - \$995.00**

**** QUALIFIED PERSONNEL ONLY**

ESN=82123456 SCM=14
MIN=514-555-1212

MOTOROLA CABLES - \$225
AUDIOVOX SOFTWARE - \$499
MITSUBISHI SOFTWARE - \$499
NEC SOFTWARE - \$399
MOTOROLA G2 OR MPC \$99



1-514-931-5162

Write in 40 on Reader Service Card.

WANTED: TEST EQUIPMENT SERVICE MANUALS! And catalogs, for HP, Tektronix, Fluke, other manufacturers. Pepper Systems: 214-353-0257; 214-902-9511 FAX.

SCHEMATICS AND parts location for either Soar MS-3015 or Tenma 72-335 portable oscilloscope. John, 912-922-8244.

WANTED: BUYING service manuals for medical equipment. Want service manuals (or copies) for hospital and laboratory equipment. Specialty Equipment Resources, PO Box 879, Goshen, CA 93227. Phone/FAX 209-734-7709.

MISC. ELECTRONICS FOR SALE

DID YOU KNOW that old personal computers, monitors, modems, electronic cash registers, and even old calculators contain valuable IC chips that are plated with pure gold! My "Big Color Photo" (8" x 10") shows over 25 of the most common gold plated IC Chips and the price I will pay for them. Chips are shown actual size. The price of gold keeps climbing higher and higher and is making it worthwhile to tear apart old equipment. To order "The Big Photo" send \$15 to Jim Sciuto, Box 128, Methuen, MA 01844.

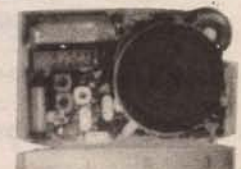
FIBER OPTIC TRANSMITTER/RECEIVER SALE. Enables you to transmit composite video images from any video source (cameras, VCRs, etc.) over fiber optic cable instead of coax. Complete package includes transmitter, receiver, and two AC adapters. Brand new in the box. Only \$49 or two for \$79 while supplies last. Credit cards okay. Write or fax 501-223-9406 to order. **Software City**, Box 23016, Little Rock, AR 72221.

RARE EARTH MAGNETS. Very strong! Various sizes and shapes. Wide range of uses, priced to sell. Call STC at 616-849-1800.



SOLAR-POWERED FAN HAT. Baseball type hat with solar powered fan. Great for sports fans, golfers, etc. Available in red or blue. \$19 plus \$2.00 shipping. CA residents add 7.75% sales tax. Visa/MC/Disc/Amex OK. H.T. Orr Computer Supplies, 249 Juanita Way, Placentia, CA 92670. 714-528-9822, 1-800-377-2023, FAX 714-993-6216.

ELECTRON TUBES wanted. Cash for all types. Daily Electronics, Suite B-6, 10914 NE 39th St., Vancouver, WA 98682. 360-896-8856, 800-346-6667.



CHEAP RECEIVERS! Motorola tone/voice pager boards. Complete, less case. Experiment, use for radio control, etc. Choice of 35MHz, 43MHz, 152MHz, or 450MHz. Order part #NZ525, Wt 3 oz., \$6 ea., 5 for \$25 + UPS. MDM Radio, Ltd., 7112 W. Roosevelt Rd., Oak Park, IL 60304. Tel. 708-848-4210.

TUBES, NEW, unused. Send self-addressed, stamped envelope for list. Fala Electronics, Box 1376-3, Milwaukee, WI 53201.

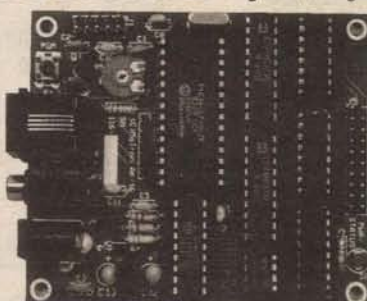
BUYING GENUINE UNMODIFIED TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. JERROLD DPV and DPBB. PIONEERS, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

FOR SALE: 500+ 1.5V micro miniature motors. \$2 each, OBO. 210-674-4900.

PHAZER RADAR/LASER JAMMER COMBO. Jams all police radar. No more tickets or they're paid for! 3-yr warranty. 30-day money back guarantee, \$197.95 complete. MO/Visa/MC/COD. Kortesis Marketing, Box 460543, Aurora, CO 80046. 303-548-3995, FAX 303-699-6660.

CNC BUILDERS: stepper motors, machines, linear rails, several sizes of stepper motors, some servo motors and misc. drivers. Industrial equipment removals. Price list. Jim DuBois, 330 State Road 101, Amherst, NH 03031. 603-673-3645.

Motron 310 Garfield St Suite 4 Control your home from your radio!
Eugene, Oregon 97402 PO Box 2748
Only \$99.00 Plus S/H



VISA, MasterCard, AMERICAN EXPRESS, DISCOVER.
COD (\$5) on CASH or MONEY ORDER basis only.
S/H: \$6 USA; \$10 CANADA; \$15 FOREIGN. Price and Specifications are subject to change without notice.

Catalogs are also available via the Internet motron.info@emerald.com
Info: (541) 687-2118 **Orders: (800) 338-9058** Fax: (541) 687-2492

Roger's Systems Specialist

Call 800-366-0579

"We Have Great Connections"

Cables ★ Connectors ★ Accessories

**Computer • Telecommunications
Network • Audio • Video**

© 1993

Active VGA Splitter

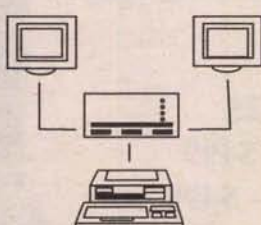
one computer to multiple monitors
Transmission Distance: 210 feet per outlet

up to 4 monitors

#CA-VGA1-4
\$119

up to 8 monitors

#CA-VGA1-8
\$139

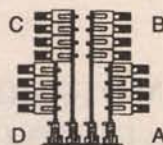


Simm Converter

30 Pin memory can be used in 72 Pin mother Board
Ideal for all service, repair and upgrade business
Left and right versions - use of all available slots

\$15.00 each

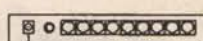
#CA-MEM-A
#CA-MEM-B
#CA-MEM-C
#CA-MEM-D



NEW - LOWER PRICE!

Ten Base -T Hub

- 8 RJ/45 Ports
- AUI or BNC input
- I-EEE 802.3 Specifications
- Daisy Chain Port for Cascading



#TM-TBT-HUB **\$139.00**

Ten Base "T" Cables

Category 5 / PVC Jacket

\$4.00	6 ft	#TE-068-L5
\$6.00	12 ft	#TE-128-L5
\$8.00	25 ft	#TE-258-L5
\$14.00	50 ft	#TE-508-L5
\$26.00	100 ft	#TE-108-L5

CLOSE-OUTS!

Limited to stock on hand
Power "Y" for speed display 12/5vDC
50¢ #TM-WRE

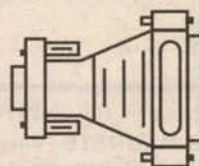
3.5mm F/F stereo coupler
50¢ #AD-508

4 pc stick-on rubber feet 1" diameter
50¢ #TM-FET

Blank slot filler plates for case
25¢ #TM-BKT

4pc drive bay-blank filler 3.5 and 5.25"
50¢ #TM-120

Serial Adaptor



DB9 male to DB25 Female

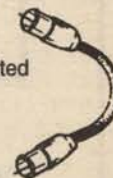
#CA-259 **50¢**

Quick connect "F"

- 6ft-heavy duty
- 24K Gold connectors
- Double shielded - Double insulated
- Professional Quality

#VC-6FT-QG **\$2.50**

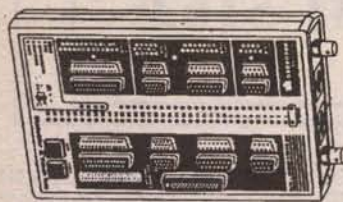
• Call about 12 feet availability



Paladin PC Cable Tester

Tests DB9, DB15, DB25
36 centronics
RJ-45, RJ-11, BNC & HD15
36 Individual L.E.D.'s for each line

#TM-157 **\$139.00**



MAC Cable Tester

Tests DB9, DB15, DB25,
DIN5, 50 centronics,
Mini DIN 4/8
RJ-45, RJ-11, BNC & HD30.
50 Individual L.E.D.'s for each line

#TM-159 **\$159.00**

AC to DC Converter

Universal multi-voltage
1.5v - 12v DC 6 different
connectors and polarity switch
500ma #TM-307 **\$3.00**
1000ma #TM-310 **\$5.00**

Microphones

This microphone is ideal
for sound input into your
multimedia applications
7ft cord 1/8" stereo jack
Includes stand with double
face tape for mounting

#TM-MIC-2 **\$3.00**

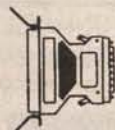


SCSI II Adaptors

HD 50 male to
50 Centronics female
#CA-015 **\$17.00**

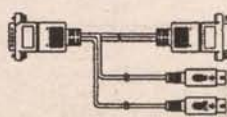
HD 50 female to
50 Centronics male
#CA-017 **\$17.00**

HD 50 female to
DB25 male
#CA-018 **\$21.00**



MIDI Cables

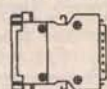
Musical Interface
Soundblaster compatible
4' DB15 male-female
2 - 5 pin DIN male



#CC-155 **\$15.00**

SCSI II Adaptor

HD50 male to DB25 female



#CA-016 **\$21.00**

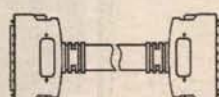
SCSI I and SCSI II

3' SCSI I to SCSI II
\$18.00 #CC-679

6' SCSI I to SCSI II
\$24.00 #CC-686

3' SCSI II to SCSI II
\$24.00 #CC-678

6' SCSI II to SCSI II
\$30.00 #CC-678-6



SCSI III also available

Automatic Wire Stripper

- Automatically adjusts to wire size
- Strips 10 to 26 gauge wire
- Connector crimper
- Wire cutter

#TM-NIC-1 **\$6.50**



Stereo Headphones

For Sound Cards or Compact Disc
10 FT Cord Super-Dynamic

#TM-170 **\$5.00**

High Quality
Walkman Type
#TM-171 **\$2.00**

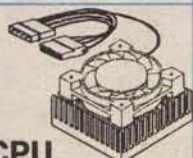
Digital Stereo Headphone
Mono Microphone Combo!

#TM-169 **\$17.00**



Heat Sink with Fan

Easy power hook-up! works with
ZIF Socket Clips to Chip



486/66 CPU Pentium 586/90 CPU

\$6.00 #TM-FAN-2 **\$9.00** #TM-FAN-90

Duplex Wall Plate

Top Quality
Beige Color
MFG By Allen Tel
UL & CSA Approved
6 position 6 conductor



#TE-WPD-6
(RJ-11)

other phone accessories
available

Blow Out!! 30¢
ANY quantity



805-288-2288

Remember, We Have Great Connections...For You! Fax **805-288-2293**

\$10.00 minimum order required • Add \$4.50 for shipping for pre-paid orders • California residents add 8.25% tax
Call for quantity discounts • No out of state checks accepted • Most orders shipped same day • Drawings are representations only

21021-504 Soledad Canyon Road, Santa Clarita, CA 91351



MISC. ELECTRONICS FOR SALE cont.

SEM ELECTRON microscope, ISI Super-II \$4,000, will need some work: EAI TR-20 analog computers sold as a pair \$1,300. Call 305-720-5310, FAX 305-726-0967.

SHORTWAVE, AM/FM cassette player for your car or truck, fits in dash. New German Decker radios \$950 plus shipping, optional 5 disc CD player. Contact Martronics, 805-239-1932. Visa/MC.



SPORTS RADAR PRICE BREAK-THROUGH! Tracer Scout professional K-band radar with DSP technology. Now only \$795. Tracks objects moving 0.5-295 MPH almost instantly, vehicles over 1/2 mile away! Switches for .1 MPH readout, fastest speed recall, low speed cutoff. Remote display interface. Baseball, tennis, racing, carnivals, etc. Two-year factory warranty. Credit cards accepted. AIS, Rt. 4, Box 664, Spiro, OK 74959. 918-962-3349. Fax 918-962-2148.

ELECTRONIC ASSEMBLY MACHINERY. We buy and sell assembly machinery including solder machines and board cleaners, insertion machines and lead formers. Petlock Inc., Rialto, CA. 909-877-8900, FAX 909-877-8902.

\$1,000,000 ELECTRONICS distributor inventory! Semiconductors, receiving tubes, loads of amp connectors and much more. Call/Fax for immediate quotes. C&H Distributing, 215 S. George St., York, PA 17403. Phone 717-843-7881/Fax 717-843-3875.

TUBES \$2.98, 1,000 types. Also surplus components. SASE brings list. DNF, 6690 7 Mile Rd., South Lyon, MI 48178.

TUBES, NEW, up to 90% off. SASE. Kirby, 298 W. Carmel Dr., Carmel, IN 46032.

SOLAR ENERGY systems and supplies. Top quality solar panels \$599; charge regulators \$99; 1000 watt, 1500 watt peak inverters just \$399. While supplies last. Elk Industries, Inc., 3389 Sheridan Street, Hollywood, FL 33021. Phone 954-963-2948. E-Mail: LASEROB@aol.com

COMLINEAR CORP wideband, fast settling op-amp #CLC220A1. Features: -3dB bandwidth of 190MHz, 0.1% settling in 8ns, 7000V/ms slew rate, 1.9ns rise and fall times, low distortion, linear phase. \$50 ea., 2 for \$90, 10 for \$400. Current list \$159 ea. Call Roger @ GS&E, 716-338-7001, VISA, MC, Discover.

AMISTAR AI-500 semi-automatic axial component insertion machine with AL-300 loader and approx. 300 component reels. A1 condition. Old Heller Leadmaster in good working condition. FOB Lexington, KY. \$1,500/OBO. 606-253-2599 X-170.

DEC ADMPC-A2 analog to digital converter, \$75. Siemens x-ray tube, AGFCu4S-T \$100. Westinghouse type KI-231 power factor meter, 120 volt, 5 amp, \$25. General Electric Series Three CPU/programmer unit, power supply, no key \$25. 515-232-7528.

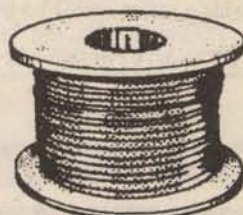
HIGH ENERGY electromagnetic radiation generator. These units can destroy semiconductors throughout a car or house. Unit only requires 6 components to build. Costs less than \$25 to build. Plans only. Send \$5 to R. Rhoades, 545 Stewart Dr., Vista, CA 92083.

POWER INVERTERS 10, 5 to 16.5 VDC in, 115VAC True RMS $\pm 5\%$ out @ 60Hz, modified sinewave, 90% efficiency, 2 yr. warranty. 100 watt (800W surge) \$89, 400 watt (3000W surge) \$289, 700 watt (3000W surge) \$369, 1,300 watt (6000W surge) \$569. Dexis Corp., 612-944-7670.

HALE-BOPP. Another global flood? 2 hr. VHS video. Dealers wanted. \$19.95. Rose, POB 7589, Chula Vista, CA 91912.

EUROPEAN PAL-TYPE TV connectors, hex drive chassis mount. Male & female available. \$0.30 each. Visa, MasterCard or COD. 702-795-0644.

PMTs: WORLD'S largest private stock. Also NIM, CAMAC, optics, neutron detectors, UHVac, high voltage, W/T pressure gauges, nuclear components, scintillation plastic, NaI(Tl) crystals, and much more are available from OE Technologies. We can supply components and equipment for individuals, colleges, universities, and R&D organizations. We guarantee high quality at reasonable costs. For current catalog, contact OE Technologies, PO Box 703, La Madera, NM 87539. 505-583-2482.



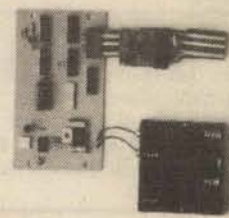
ANAHEIM WIRE PRODUCTS. DISTRIBUTOR OF ELECTRICAL WIRE AND CABLE since 1973. Items available from our stock: Hook up wire, Automotive primary wire, GXL, SXL, Plenum cable, Teflon wire, Multi-conductor cable, Irradiated PVC, SO-CORD, Mil-Spec wire, Building wire, Welding cable, Battery cable, Telephone wire, Shrink tubing, Cable ties, Connectors. If interested, please call 1-800-626-7540, FAX: 714-771-5043. Visa/MC.

SOLAR KINGS, material still available. Call/SASE for catalog. BNFE, Rte. 1S, Peabody, MA 01960. T508-536-2000, F508-536-7400. WWW.BNFE.COM Since 1964.

GEARED MOTOR assembly for 10 or 12 speed bike. Develops 1/2 HP. Can be switched to generator mode to recharge battery while riding. Plans \$10, motor \$20, geared motor assembly \$140. C.T., PO Box 461, Sheboygan, WI 53082. 414-451-6892.

As Seen On "Good Morning America"

EASILY DISARM MOST AUTO ALARMS in less than 10 minutes with the Alarm Dominator Jr!



- ▶ Portable, remote device needs no access to auto.
- ▶ Easy to use, just flip a switch and wait for the "Chirp, Chirp."
- ▶ Perfect for locksmiths, law enforcement, alarm installers, repo pros, tow truck operators, etc...
- ▶ Battery operated PC board measures just 2 1/2" X 4 1/2" and comes complete with easy to use instructions.

Sales to qualified buyers ONLY. Prepaid orders, C.O.D.s, and the American Express Card are gladly accepted.

Easy to Build Kit : \$69.95
Assembled & Tested: \$99.95
Enclosure: \$10.00
Standard Shipping: \$5.00
Dominator Technologies, Inc.
12062 SW 117 Ct., Suite 132
Miami, FL 33186
(305) 271-2737

Write in 152 on Reader Service Card.

❖ ATTENTION CABLE VIEWERS ❖

CABLE VIEWERS... get back to your BASIC Cable Needs



BASIC ELECTRICAL SUPPLY & WAREHOUSING CORPORATION

Call 1-800-577-8775

For information regarding all of your **BASIC** cable needs.

5 GOOD REASONS TO BUY OUR FAR SUPERIOR PRODUCT

- ❖ **PRICE**
- ❖ **EFFICIENT SALES AND SERVICE**
- ❖ **WE SPECIALIZE IN 5, 10 LOT PRICING**
- ❖ **ALL FUNCTIONS (COMPATIBLE WITH ALL MAJOR BRANDS)**
- ❖ **ANY SIZE ORDER FILLED WITH SAME DAY SHIPPING**

We handle **NEW** equipment ONLY - Don't trust last years **OBSOLETE** and **UNSOLD** stock!
COMPETITIVE PRICING — DEALERS WELCOME

It is not the intent of B.E.S.W. to defraud any pay television operator and we will not assist any company or individual in doing the same.
*Refer to sales personnel for specifications.

P.O. Box 8180 • Bartlett, IL 60103-8180 • 708-582-2099

RADIO SHACK catalog merchandise, all working condition, save 50-60% from catalog price. Everything from phones, Ans. mach., alarms, radios, games, CBs, Walkman, etc. Please call or fax for information: 215-657-3119. Write: MEM Electronics, 3119 Burn Brae Drive, Dresher, PA 19025.

VOICE CHANGER board! Fully assembled and tested! Not a kit! 16 levels of change, many applications! \$39.95 + \$4 (S&H) US funds! **PARSEC Electronics**, PO Box 34594, Phoenix, AZ 85067.

I BUY, SELL, repair telephones, systems, voice mail, computers, monitors, printers, HDDs, memory, fax machines, smaller copiers, test equipment (Wavetek model 3510, 1-1000 megahertz signal generator, GPIB, \$900). Attn: Doug 509-484-5652, Fax me your list for estimates or quotes. 509-484-5652.

"AA" NICD BATTERIES NEW! Prices \$6.50/sixpack, \$54/carton (60) \$475/case (600). NEW chargers \$6 each, manufactured for DAK. Under The Wire Electronics (UTWE), 235 E. Colorado Blvd. #211, Pasadena, CA 91101. Or call 818-930-1121, fax 818-930-1123.

24VDC @ 7.2 amp linear Power One reg. power supply, new! \$30 ea., 2 for \$50. Call Roger @ GS&E, 716-338-7001. VISA, MC, Discover.

SOLAR CELLS: Various shapes & sizes .45 volt .3-3.5 amps. Ideal for school projects or for building your own panels. 5 watt SOLAR PANEL KIT includes 40 cells, tabbing, frame & plexiglass \$39 + \$5.95 S&H. We specialize in small, low cost solar panels & cells. Call or write for price list & specs (sorry, no catalog). Tropico Solar, PO Box 417-NV, Big Pine Key, FL 33043. 305-872-3976 Fax 305-872-0797.

VIDEO GEAR: TEKTRONIX, SONY, IKEGA-MI, GRAFTEL, ETC. SEE AD UNDER "VIDEO." 802-860-1180.

SOLDERING STATIONS: Refurbished like new Weller EC2000ESD EC2001 \$100; EC2001ESD \$150, WTCN \$50, EC1201 pencil \$60, nu tips \$3, EC2000 thru EC2002 repairable circuit boards or for parts \$25; Hexacon sol. sta. \$45; Wellman sol. sta. \$250; Teledyne thermal wire stripper \$25, \$30; Lindstrom precision tools \$10; air powered hot air for surface mount \$200; Ungar station pencils \$25, nu \$50; desoldering stations: (vacuum pump built-in) Pace \$250, Ungar 4624 nu \$400, Weller DS600 \$250, DS1000 \$500. Ask Jim 310-815-9090.

100 CABLE analyzers made by ITT. Test opens/shorts on up to 100 lines automatically. Used, sold as-is. Make offer. ISE Ph: 210-350-5555 FAX: 210-350-5574.

CIRCUIT BOARD card holder for proto and short run production. Holds small parts close to board for speedy assembly and soldering. Will handle board sizes 1.5" to 6". Special price \$29.50. EO Techniques, 16 Slusser Ave., New Hartford, NY 13413-2117. Phone 315-733-4852.

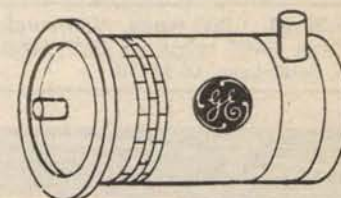
SURPLUS CABLE. Coaxial, multiconductor, fire rated, plenum, many types available. Request list. Detection Dynamics, 512-926-8811, FAX 512-926-0940.

PC BASED CNC Affordable 3 axis motion control systems compatible with industry standard G-Codes or plot files from AutoCad/Generic Cad. Ideal for milling machine retrofits or custom machines. Complete plug and play servo and stepping motor systems both capable of 3 axis linear and 2 axis circular interpolation. Individual components including software, motors, amplifiers, translators, power supplies and I/O cards. Desktop milling and engraving machines also available. Call or write for free info. **JRA, 3602-1 PARTRIDGE PATH, ANN ARBOR, MI 48108.** 313-973-0928 VOICE/FAX E-Mail address: jjoyner101@aol.com

12 TO 15V @ 11 AMPS Reg Switching Power Supply. New in the box by Power One \$30 ea., 2 for \$25 ea., 10 for \$20 ea. Call Roger @ 716-338-7001. VISA, MC Discover.

TUBES-SOCKETS-Connectors buy-sell. Send SASE for list "R" also selling teletypes and repair parts. List "T" Typetronics, Box 8873, Ft. Lauderdale, FL 33310-8873. Fred Schmidt N4TT, 954-583-1340.

CAR BODY for electric conversion. Mechanically worn, but body, undercoated new, still good shape. 87 Plymouth Horizon, similar VW Rabbit. One owner. Near Grand Rapids, MI. \$250 U-Haul, \$275 I-Haul with-in 100 miles. 616-897-6885 evenings.



ELECTRIC CAR GE motors designed for EVs. Series and shunt motor systems include: Controller, accelerator switch and digital display. Discount prices. Send \$5 for specification and price sheet to: DM3 Electrics, PO Box 14574, Scottsdale, AZ 85267-4574.

CLOSEOUT ITEMS from BNF, wind speed indicator kit \$5, \$13/3, Tesla coil kit \$19, \$55/3. Fan/motor speed control \$3, \$10/4. 2 1/2" ID 1 1/2" D. Solder pot \$3, \$13/3. Voice/sound activated switch modu. \$1. Components by the foot assorted, \$1/10. 500 pts, 4" x 10" car/TV speakers \$2, \$10/6, 2 speed Sw. motor/lamp control \$1/2, 12/\$5. Mallory Sonalert SC628 \$3.50, \$16/5. Security keylock switch, w/2 keys \$3/2. Cable boxes Oak L30 or Oak G26 \$3, \$10/4, mix or match, all working units. 9" Sony TVs, hospital surplus req's mod'ts w/data \$15. 6 x 9 TV speakers \$1, \$5/6, right angle R connector M to F screw on \$1/2, \$5/12. 14550 UART \$2. Our 32nd yr. Send SASE for flyer. BNFE, Rte. 1S, Peabody, MA 01960. WWW.BNFE.COM T508-536-2000, F508-536-7400. Since 1964.



PC BOARD CARBIDE DRILLS! As low as \$0.30 each! Also electronic surplus. Send or call for free flyer. Hoffman Industries, 853 Dundee Ave., Elgin, IL 60120. Ph: 708-622-8201, Fax: 708-622-8202.

CASH PAID for pagers. 210-674-4900.

THREE-PHASE INVERTERS for AC motors, 1-10 HP, single and three-phase inputs. ALSO: Servo drives & motors. 802-860-1180.

±12 TO ±15V @ 5 amps linear by Power One, reg. power supply, new! \$30 ea. 2 for \$50. Call Roger @ GS&E, 716-338-7001. VISA, MC, Discover.

Buy Direct and Save!

Satellite Television
FREE Information Pak
Buyers Guide

800-350-0256

24 Hour Voice Mail - Press # 1 for Catalog

Internet Address: [HTTP://WWW.FISHNET.NET/~Termond/](http://WWW.FISHNET.NET/~Termond/)

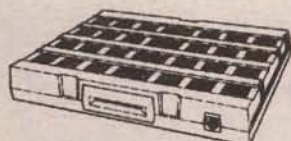
Digital Satellite
200 Channels



Complete Basic System

\$489

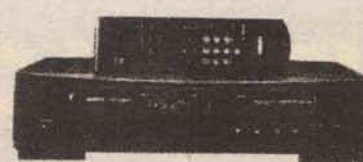
After Mail In Rebate!



VCRS
Decoder
\$329

Von Weise 24"
Quietest Jack
High Count 48 per inch

\$119



Uniden Ultra or HTS 20
with VCRS Decoder

150 Free Channels
Low Prices on Programming
Raw Feeds.

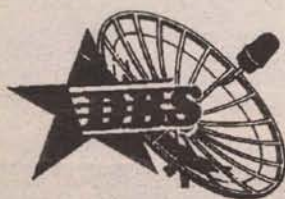
Complete Basic System

\$899

Includes 6' Dish/ LNB/ Feed /
Jack & Motor / Receiver & Decoder



25 LNB \$59
20 LNB \$79



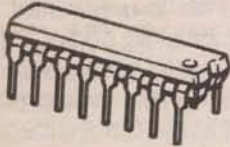
14 Years Experience / Over 45,000 Customers
DBS Satellite 2316 "A" Channel Dr.
Ventura, Ca. 93003-4522
805-652-0255 Fax 805-652-2190

MISC. ELECTRONICS WANTED

WANTED: OLD, new, used, Western Electric, RCA, Telefunken, GE, Jan, McIntosh, Marantz, Dyna, Fisher, JBL, EV, Tannoy, Jensen, EMT, Thorens, Fairchild, Altec, Westrex: **TUBES**, speakers, amps, etc. Maury Corb, 713-728-4343, FAX 713-723-1301.

WESTERN ELECTRIC audio equipment wanted. 1927-1960's. Amplifiers, "receivers," speakers, x-overs, tubes, etc. 1-800-251-5454.

WANTED: ELECTRICAL materials, Allen-Bradley, Agastat, Appleton, Crouse-hinds, T&B, Square D, Pyle National, Russel & Sfoli, circuit breakers, fuses, connectors. Call Beiner Sales, 805-376-9044, FAX 805-376-8208.



WANTED: EXCESS ELECTRONIC INVENTORIES, ICs, MEMORY, EPROMs, PALs, LEDs, CIRCUIT BOARDS, DIODES, AND TRANSISTORS. CALL ACTIVE MICRO, 310-494-4851 OR FAX 310-494-4913.

EXCESS INVENTORY WANTED: Transistors, semiconductors, capacitors, PC boards, & diodes. We buy it all! Contact: **SEMITECH, INC.**, 334 Cooper Road, Bldg. A., Berlin, NJ 08009. Phone 609-768-0030, FAX 609-768-5690.

ELECTRON TUBES: Microwave, transmitting, receiving, obsolete, ALL TYPES; large inventory. Contact Daily Electronics, Suite B-6, 10914 NE 39th Street, Vancouver, WA 98682. 360-896-8856, 800-346-6667.

DO YOU have aluminum anodizing knowledge, experience, or equipment? Will trade your small set-up or info. for my cash or tool-makers services. Call Phillip, 408-244-0728.

WANTED: TUBE HiFi, Tube theater/commercial amps, speakers etc. Cornen speakers/coaxials/triaxials. Old guitars & guitar amps. Altec, McIntosh, Marantz, Western Electric, Scott, Fisher, Dynaco, Electrovoice, Jensen, Gibson, Fender, Vox etc. Sonny Goldson, 1413 Magnolia Ln., Midwest City, OK 73110. 405-737-3312. FAX 405-737-3355.

RADAR SETS Wanted. WWII 1970 X-band, military, civilian working or not, books, TMs, parts. SHF, Box 10215, Pittsburgh, PA 15232-0215.

WANTED: ELECTRON tubes, ICs, semiconductors. Astral, PO Box 707NV, Linden, NJ 07036. Call, 1-800-666-8467.

LCD COLOR PANELS/PROJECTORS WANTED working or not. Fax description and price to 610-935-7666 or call 610-983-0100 ask for Neil.

BUYING GENUINE UNMODIFIED TOCOM, SCIENTIFIC ATLANTA 8536s, 8550s, 8580s, 8590s, and 8600s. **JERROLD** DPV and DPBB. **PIONEERS**, all, and Zeniths, all. Any quantity. Top \$\$\$ paid. Contact National Cable Brokers, Plymouth, IN. Phone 219-935-4128.

OBSOLETE ICs, SLOW OR BAD SIMMS. We buy mother bds. All types of memory bds. **EVEN SOLDERED IN CHIPS.** We buy it all. Call John at L&M Technical Recycling. 1-800-514-3447.

TOP DOLLAR for gold plated scrap chips, tabs, components, etc. Ron, 817-838-0938.

TESTERS WANTED: Immediate offers made for Ultrasonic, Magnetic Particle, Eddy Current, X-Ray and Borescopes, 24hrs. Leave detailed message with make/model. 1-800-530-3371.

INVERTER OR UPS wanted to operate from 12, 24, 48 DC with outputs 5 to 10KW at 115/220 VAC, sinewave 60Hz. FAX 507-226-5292; 507-226-7555. Movil Com, SA, PO Box 025523, Miami, FL 33102.

WANTED: ALTEC mics, mixers, compressor's limiters, EQs speakers, and horns. Also, highest prices paid for Western Electric Tubes. Call Don, 715-246-3899.

CASH FOR your old telegraph instruments of any kind, also books, signs, etc. Have a few items for sale. Goodman, 636 Grant, Charleston, IL 61920.

WANTED: CB only signal generators, B&K 2040, Sencore CB 42, Hickok 266, with manuals, specs. 405-447-5689, 405-360-6817.

EXCESS INVENTORY WANTED: Commercial and military. ICs, diodes, transistors, caps, relays, connectors, wire, and cable. **M&M SALES**, 602-807-8604 OR FAX your list to, 602-807-3320.

I WANT it and I want it now. I want all of your SIMM memory. IBM, Mac, new, used, even defective. I want it all. Highest \$ paid. Now selling memory. We can beat any printed price in Nuts & Volts. Call 1-800-4-MEMORY now! Voice/FAX.

GUITAR AMPLIFIERS WANTED: TUBE TYPE, OLD, NEW, BROKEN. ALEX, 610-767-9097.

CONSUMER ELECTRONIC parts wanted: Semiconductors, transistors, diodes, fuses for TVs, stereos, VCRs, computers. Japanese, European, American. ECG, NTE, SK. Parts must be in new condition, preferably in factory packaging, tubes, sealed plastic bags. LJ Enterprises, 302-369-1590, FAX 302-369-1594.

STOCK TICKERS, Edison, Western Union, Postal Telegraph, or others. Telegraphy instruments, keys, sounders, etc. Railroad dining car china, silverware, holloware, linens, menus, time tables. 217-345-6771, Goodman.

WANTED: FLYBACK transf. #JF278 for Mitsubishi projection TV model #VS-506U. 2922-73 St., Kenosha, WI 53143. Call John, 414-652-5073.

ATTENTION. I am looking for an assembled device to change human voice into a robotized electronic digitized voice. Hoping the device you have is clear to the ear, vowels clear, outlet powered. John Guillen, 314 Zecca, Gallup, NM 87301. Phone 505-722-8881.

★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★

CABLE TV CONVERTERS

★ AS LOW AS \$25.00 WITH REMOTE ★

TIMELESS PRODUCTS

550-PC
THE HOTTEST
CONVERTER
EVERYONE'S
AFTER!



WORKS
PERFECT WITH
DECODERS.
DOES NOT
DECODE

THE BEST CONVERTER ON THE MARKET.
PERIOD!!!

PANASONIC

TZPC145 3G2
THE OLD STAND-BY
NOW BACK IN STOCK



ALSO: TZPC175 DG2
VOLUME CONTROL

NEW REPLACEMENT REMOTES — MOST CABLE MODELS
NEW WITH FULL WARRANTY!

★ REFURBISHED CONVERTERS ALSO AVAILABLE! ★

WE'RE THE LARGEST STOCKING DISTRIBUTOR
OF TPI CONVERTERS BECAUSE *WE ARE...*

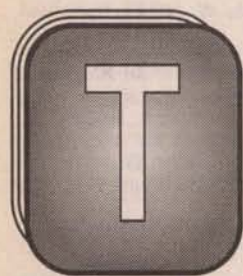
TIMELESS PRODUCTS

(218) 346-6665

DEALERS ONLY — BEST PRICES — CALL!!!!

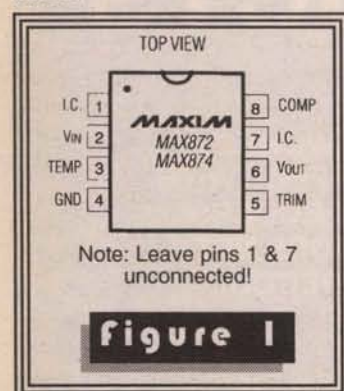
NO "PANS" OR "ACTIVATED" DECODER SALES

★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★ CONVERTERS ★



To begin this article, let's take a look at one outstanding example of what is currently available in integrated circuit voltage references. A voltage reference, especially the high-precision type that will be discussed, is useful for any number of applications. You'd be surprised at its diversity! Just a few uses are:

- For establishing an internal baseline reference DC voltage level for instrumentation of all kinds.



- As a reference for power supplies, so as to set the stability of their output voltage level.
- To establish an external known reference to calibrate equipment against.

And they are per-

fect for what one might call "unusual" applications. Many examples are possible. Here's just one to stimulate your creativity ...

Consider a battery-powered, 60 Hz synchronized inverter. Inverters are used for any application where a battery voltage is stepped up to a standard AC voltage; 120 VAC and 240 VAC at 60 Hz being the most common configuration by far.

Most common-market inverters utilize a power transformer in conjunction with an RC feedback network to get approximately a 60 Hz output, but this varies under load due to complex interactions between the transformer, battery, and power elements of the circuit. Not good for frequency-sensitive equipment used in audio or video, and double-plus "ungood" for precision timekeeping applications!

Rather than abandon the synchronized 60 Hz inverter, there are circuits that amplify the precisely timed signals leaked from and broadcasted by 60 Hz power lines — even if they are miles apart. Those amplifiers then adjust the frequency of the inverter to match. No more audio, video, or timing problems.

This is accomplished by first processing the weak AC signal input from the distant power line and then comparing it to a fixed DC voltage reference. Excursions beyond the threshold values

detected are treated as valid signals, and the circuit will proceed to click on the power oscillator in synchronism. Then, the inverting transformer outputs a signal in phase with the distant AC line.

Greater Precision

What makes the modern references so much better than their predecessors are their tighter tolerances in several areas. Maxim puts out several voltage references; the ones discussed here are the MAX872/MAX874 series. These are available in both SMT and DIP versions, so you can choose which package you'd like to work with. Digi-Key carries the more common versions of each, and the more specialized types (such as have extended operating temperature range) are available from the manufacturer. Exact part numbers are listed in the Parts List to help selection.

There are two voltages available. The MAX872 provides 2.500 volts, and the MAX874 provides 4.096 volts. Both have a precision of $\pm 0.2\%$ and require just 10 microamps of current to operate. While the MAX872 can be used with a

variety of analog circuits, the MAX874 lends itself as a reference for analog-to-digital and other circuits whereby an analog voltage is converted to a sensible equivalent for a digital circuit. Note the value of 4.096 volts. We see that 2 to the power of 12 is 4096. So this voltage could be used to reference 4096 binary bits — each

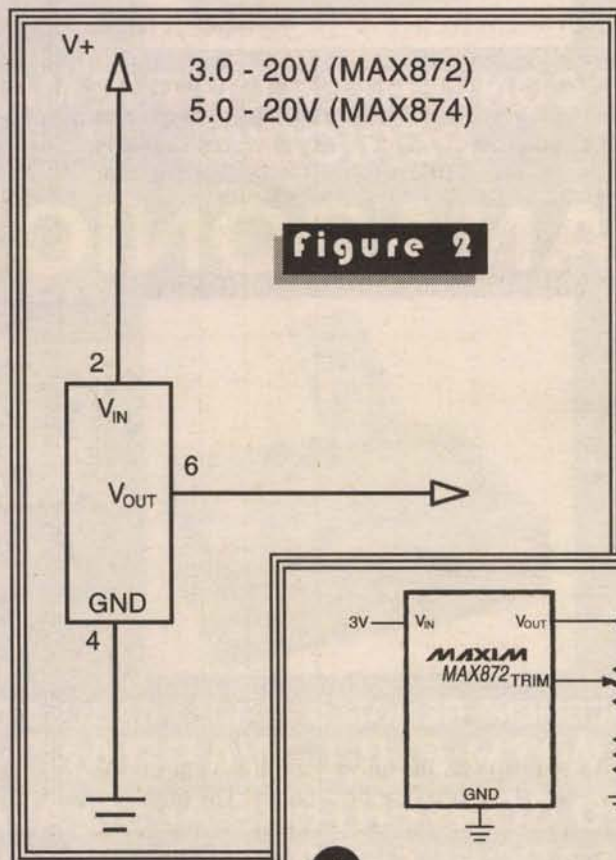


Figure 2

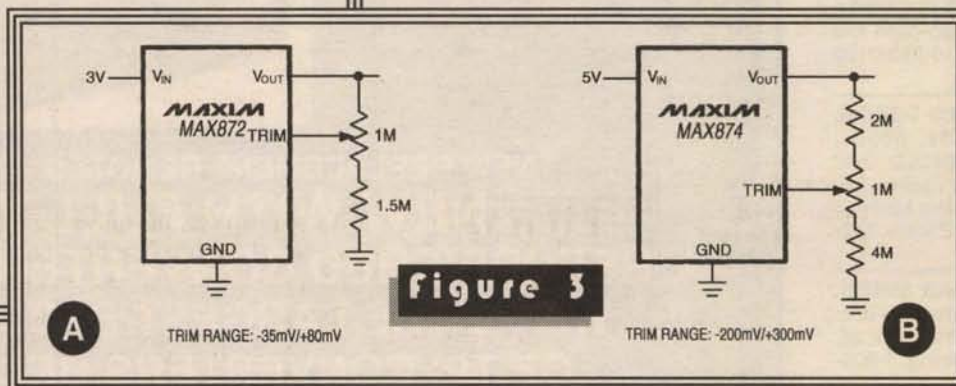


Figure 3

bit being one millivolt — utilizing a 12-bit ADC.

Both references feature "low dropout." That means the input voltage doesn't have to be much higher than the reference output for the IC to work. In both cases, it is just 200 mV, which lends the MAX872 operation from three-volt power supplies, and the MAX874 from five-volt supplies. Recommended top input voltage is +20 V, with an absolute maximum of +24 V, which is not to be exceeded or the device will destruct. One nice fea-

ture of this line is that output can be shorted to either supply rail indefinitely without damage.

Circuits

Figure 1 gives the pinout of the ICs. Figure 2 shows a test circuit. This is untrimmed and suitable for most projects, as is. By adding a precision, low-temperature coefficient potentiometer, the output voltage can be trimmed for even greater accuracy. The COMP input at pin 8 does the job for us. Just such an arrangement is shown in Figures 3A and 3B. Note the trim range is not equal in voltage from the center point of the output. However, as shown, the range is adequate for compensating out any minor discrepancies from the design voltage. In other words, you can "nail" the exact output voltage with the simple trim circuit shown. Be sure and use low-tempco 1% resistors with this circuit for best performance.

Current drain on each reference should be limited to 300 μ A or less. If the drain exceeds 300 μ A, Maxim suggests connecting a 1000 pF capacitor between Vout and GND terminals. The maximum current source or sink value for these parts is $\pm 500 \mu$ A.

Figures 4A and 4B show the output voltage plotted against the input voltage for the MAX872 and MAX874, respectively. Note the extreme stability of the output voltage despite the large excursion of DC input.

Figures 5A and 5B show another important stability factor, and that is the change in output voltage vs. temperature. Note the drop-off from 'specs at either end of the temperature extremes. These ICs are normalized to $\pm 0.2\%$ tolerance at 25 C (77 F), so that's where the greatest compliance to stated output voltage occurs.

A very neat feature of these chips is the availability of the TEMP output at pin 3. With an external circuit, this feature can insure the chips are operated within their functional temperature range.

Let's take the extended temperature range versions as an example. Their operating range is -40 C to +85 C. The TEMP voltage increases linearly at the rate of 2.3 mV/C, depending upon temperature, as referenced to Centigrade degrees above absolute zero (-273 C). Thus, at -40 C, it is 233 degrees C above

absolute zero, and multiplying this by 2.3 mV/C we get 0.536 volts. At the upper extreme of +85 C, we are 358 C degrees away from absolute zero (273 + 85) and we can solve for: $358 * 0.0023 = 0.8234$ V.

It is a relatively simple matter to make a circuit addition that will warn of excess temperatures either to the cold or hot side. A useful type of circuit is called a WINDOW COMPARATOR, and that can detect excursions beyond the extremes of two

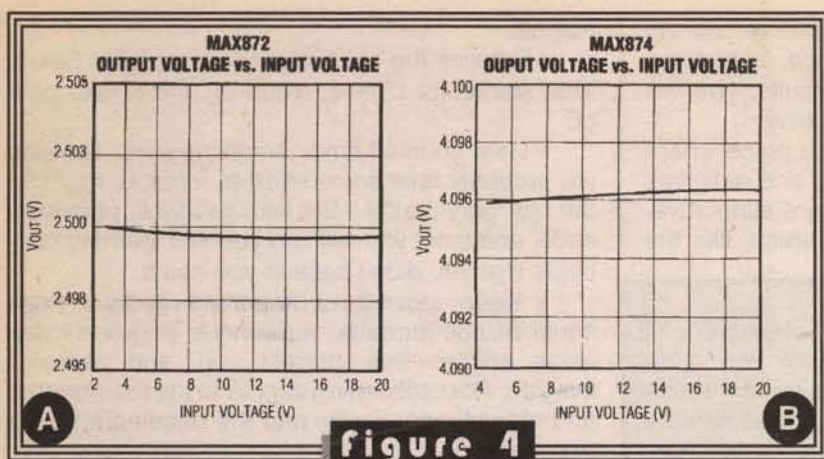


Figure 4

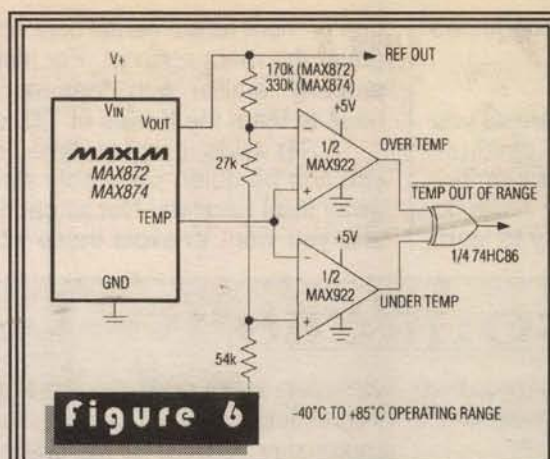


Figure 6

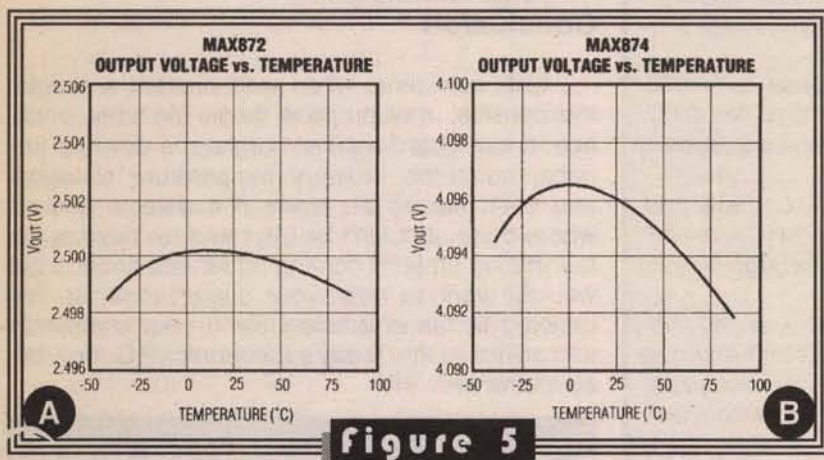


Figure 5

shows the implementation of a window comparator. An LED or other indicator can be connected to the active-low TEMP OUT OF RANGE signal for a visual indicator, or that signal may be connected to a computer input port, etc. Use 1% resistors with this circuit for premium accuracy.

Another Interesting Surfboard™ Project

Modifications to the Surfboard™ breadboarding medium enable a lot of diverse

Or even a worse nightmare is re-designing the PCB layout and re-building the circuit! (Don't laugh, such things have happened to me!) But in cases like this, building the pull-up resistor network on a Surfboard and then connecting it into the circuit may be an awful lot more expedient than a re-wire or a re-build. It's a good idea to add several of these handy PCB breadboards to your parts inventory, as they always seem to come in handy. Digi-Key is a distributor of the Surfboard line.

While there are several diverse types of Surfboards available, not all will custom-fit your application as is. Here's where a simple technique helps: Pre-plan your circuit, drawing in where the components will be. Then you can cut the foil traces where needed to modify the Surfboard for your circuit.

Next, apply a small amount of solder to the section to be lifted away. Using an X-Acto or similar modeler's knife, heat the section carefully and peel off the unwanted trace. Be careful not to heat adjacent traces, or you may find them peeling off too!

Jumpers, if required, complete the job. It is suggested to remove the solder flux using commercial solvent or isopropyl alcohol and a toothbrush.

Now your circuit is ready for testing and installation in its application. Surfboards are available both as a plain board and with pins that will fit DIP sockets, so you have a lot of latitude here.

Beginning Electronics

Several readers have written requesting advice on how to get started in electronics. This is great! While the primary purpose of *Today's Electronics* is to examine moderately advanced, state-of-the-art devices and techniques, the person wishing to get started or to hone his or her basic skills might consider checking out the reference material listed in the box. Please note this is just a fraction of the material available; like any general field, there is a mountain of data to be found if one does the looking. The listing is just

BUILD CUSTOM NETWORKS TO YOUR SPECIFICATIONS

SURFBOARD 6000 AND 6100 SERIES PROVIDE THE PERFECT PLATFORMS

With SURFBOARDS you can build a wide range of different surface mount based network configurations. Your networks can incorporate the component types and values for your specific need. Many times it is possible to also include additional devices on the same module and increase packaging density even further. While a wide range of standard commercial networks are available, they are somewhat limited to a few general types with a limited choice of component values. Surfboards are the perfect solution for building prototype and short run production custom networks to your specifications, and the S.I.P. (single in line) pins on Surfboards will make your custom networks compatible with breadboards or sockets.

A FEW BASIC NETWORK CIRCUITS AND SURFBOARD ASSEMBLY LAYOUT CONCEPTS

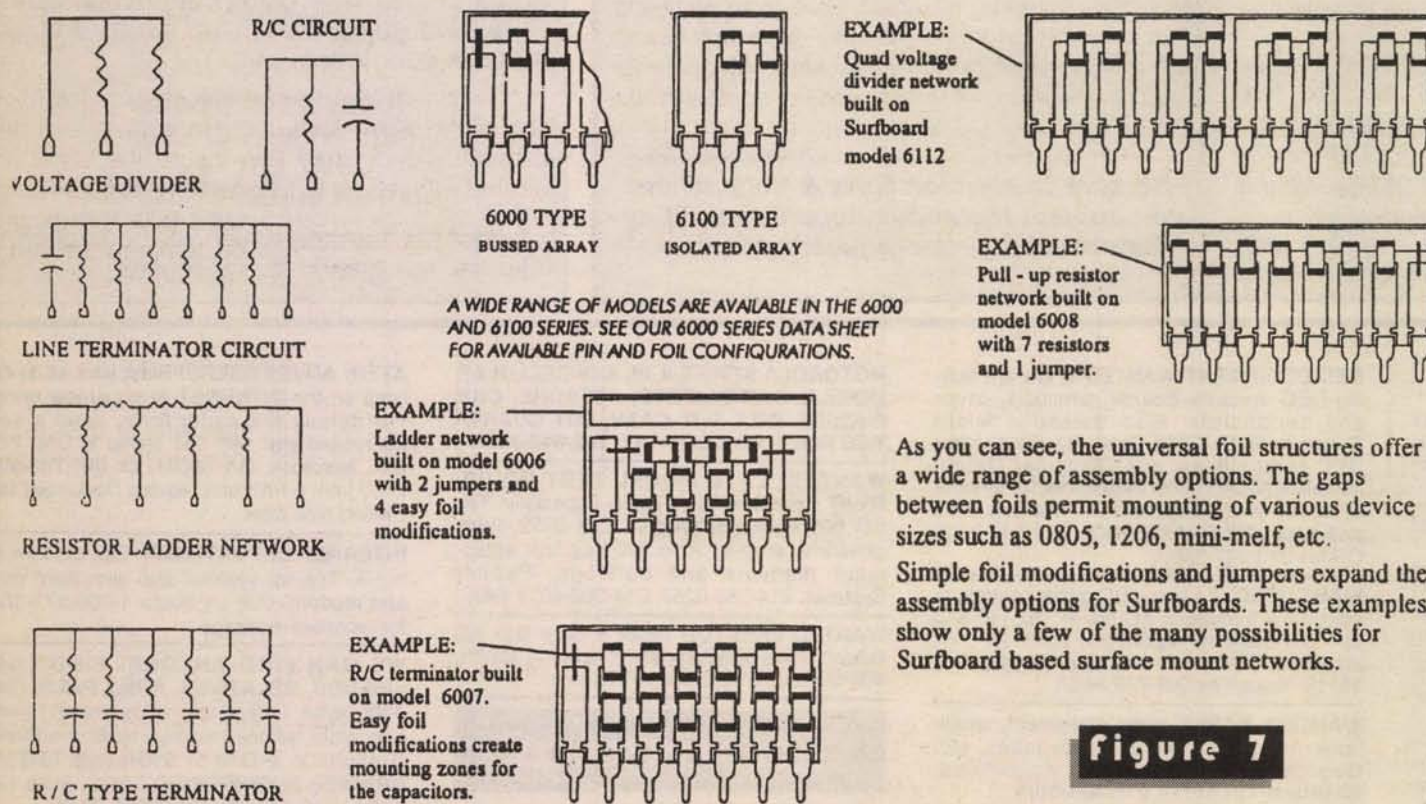


Figure 7

setpoints. If just one setpoint is required, one can simplify the circuit and use a single comparator, like discussed last time in this forum. Figure 6

circuits to be built with a minimum of hassle. Such are the examples provided by Capital Advanced Technologies (see Sources) in Figure 7. One likes

what I'm familiar with at this moment.

In many cases, the person is going to wind up teaching him or herself. Sometimes this gets con-

fusing, so the following general plan is suggested to ease the way:

- Choose what part of electronics interests you the most. TTL logic? Linear circuits? Communications? Computer circuits? Or just "tinkering?" In many cases, expect these fields to overlap. In that event, it will be necessary to learn

one or more fundamental concepts before you can grasp the main concept. For instance, to become properly familiar with computer circuits, you will have to learn the basics of TTL circuitry.

- Set aside a regular time and a place where you can be quiet, preferably alone, and definitely away from hecklers. Not all people are supportive, and you want to avoid those who aren't, like the

plague.

- Practice the old military philosophy of S-A-T. That stands for (S)ave, (A)dd-to, and (T)ake care of.

- Give yourself time. Anything worth learning will probably take some effort to force its way into the old "gray matter." But with patience, perseverance, and time, you will find yourself learning concepts that you didn't believe you could.

- Keep records of important items. These could include formulas, references, pages of magazine articles that interest you, and personal insights. Recordkeeping serves to jog the memory and maintain continuity with the ongoing learning experience.

Conclusion

Until next time, when we'll present a simple, inexpensive, multipurpose home security package. It can guard against burglars, a downed furnace, out-of-the ordinary temperature changes, and even set off an alarm if it detects sounds where there shouldn't be any! And we have some fascinating projects coming up for you soon ... but we still want to hear your suggestions for this ongoing series of articles! Send your comments and advice to the *Today's Electronics* P.O. Box listed elsewhere. **NV**

PARTS LIST

MAX872CPA-ND +2.500 volt precision reference in 8-pin DIP package
MAX873BCSA-ND +2.500 volt low power, low drift reference in 8-pin SMT package
MAX874CPA-ND +4.096 volt, 10 uA precision voltage reference in 8-pin DIP

These ICs are rated to operate from 0.0 C to +70 C. Numbers are exact Digi-Key part numbers.

Today's Electronics Reader Helpline

"*Today's Electronics*" is a reader interactive forum. We appreciate your interest, and would like to hear your comments, questions, and suggestions, for future articles. Address your letters to:

Today's Electronics

Attn: Anthony Charlton

P.O. Box 74

Cornwall Bridge, CT 06745

Your fax number, which will be kept confidential, will greatly speed replies.

SOURCES

Contact East, 335

Willow Street, North

Andover, MA 01845-5995. Ph: (508) 682-2000, FAX: (508) 688-7829. SMT and electronic repair tools; chemicals. Free catalog.

Dattek Corporation, 55 Freeport Blvd., Unit #23, Sparks, NV 89431. Ph: (702) 359-7474, FAX: (702) 359-7494. Dry transfers for PWB fabrication, chemicals, Circuit-Fix™ products. Free catalog.

Digi-Key Corporation, 701 Brooks Avenue South, P.O. Box 677, Thief River Falls, MN 56701-0677. Ph: (800) 344-4539, FAX: (218) 681-3380. Top-of-the-line supplier of SMT components; features a large selection. Free catalog.

Dyna-Art Designs, 3535 Stillmeadow Lane, Lancaster, CA 93536-6624. Ph: (805) 943-4746. Provider of and seller (through distributors, as well) of the Toner Transfer System (TTS) method of PCB fabrication. Also sells a desk-top integrated package for small OEM and prototype PCB fabrication.

Electronic Goldmine, P.O. Box 5408, Scottsdale, AZ 85261. Ph: (602) 451-7454, FAX: (602) 451-9495. SMT surplus PWBs and SMT components. Some great values here. Free catalog.

ESP Solder Plus, 14 Blackstone Valley Place, Lincoln, RI 02865-1145. Ph: (401) 333-3800, FAX: (401) 333-4954. Small manufacturer, educational, and industry SMT repair kits and solder cream.

Garrett/IEU, Inc., 3130 Skyway Drive #104, Santa Maria, CA 93455. Ph: (805) 922-0594, FAX: (805) 922-3643. Small and bulk quantities of surface mountable components.

Hobby Lobby International, Inc., 5614 Franklin Pike Circle, Brentwood, TN 37027. Ph: (615) 373-1444, FAX: (615) 377-6948. Supplier of all kinds of hobby kits and supplies; mentioned here because of their large selection of instant-setting glues and some tools that are useful to any precision endeavor such as with electronics. Catalog \$2.50.

Maxim Integrated Products, Inc., 120 San Gabriel Drive, Sunnyvale, CA 94086. Ph: (408) 737-7600, FAX: (408) 737-7194. Specialty analog and digital integrated circuits of amazing diversity and use. Call for nearest distributor or sales rep (in the case of OEMs). Will give out free info and samples to qualified companies.

Micro-Mark, 340 Snyder Avenue, Code 340-1892,

Berkeley Heights, NJ

07922-1595. Ph: (800)

225-1066, FAX: (908) 665-9383. This company calls itself "The Small Tool Specialists" and indeed they are. Listed here because of the many precision hand and power tools they offer that are useful in SMT and other electronic work. Also carries hard-to-find supplies for model making. Full-color catalog \$1.00.

Pace, Inc., 9893 Brewers Court, Laurel, MD 20723-1990. Ph: (301) 490-9860, FAX: (301) 498-3252. Manufacturer of SMT soldering/desoldering equipment and workstations.

Techni-Tool, 5 Apollo Road, P.O. Box 368, Plymouth Meeting, PA 19462. Ph: (215) 941-2400, FAX: (215) 828-5623. Soldering/desoldering equipment and electronic tools of all types.

All Electronics Corporation, P.O. Box 567, Van Nuys, CA 91408-0567. Ph: (800) 826-5432, FAX: (818) 781-2653. Some SMT parts and occasional surplus SMT boards useful for parts salvage and experimentation. Free catalog.

Capital Advanced Technologies Inc., 309-A Village Drive, Carol Stream, IL 60188. Ph: (708) 690-1696, FAX (708) 690-2498. Manufacturer of the Surfboard™ breadboarding medium for SMT, sells mostly through distributors such as Digi-Key. OEMs can contact Capital directly for large quantity pricing.

Carolina Biological Supply Company, 2700 York Road, Burlington, NC 27215. Ph: (919) 584-0381, FAX: (503) 656-4208. Laboratory supplies including test tubes, plastic, and glass vials handy for use categorizing SMCs. Contact for current price of their 30,000 item, full-color catalog.

PRB Line, P.O. Box 176, Whitewater, WI 53190. Ph: (800) 533-9654, FAX: (800) 635-8101. Carries an inexpensive SMC removal kit called ChipQuik.

Circuit Board Express, 2 Avco Road, Haverhill, MA 01835. Ph: (508) 521-9288, FAX: (508) 521-9388, Modem: (508) 373-9272, E-Mail: fastpwb@tiac.net Time crucial manufacturer for industry. Produces prototype circuit boards in 24 to 48 hours. Not a hobbyist supplier.

Be sure to mention Nuts & Volts when you contact the above suppliers so they can process your requests properly.

MISC. ELECTRONICS WANTED cont.

WANTED TO BUY: Omega OM-700 data acquisition controller, or source. Manufacturer? 603-394-0167. Internet E-Mail: karl.christofferson@castle.shore.net

WANTED: SONY Beta Hi-Fi processor model #HFP-100. Phone: Henry, 202-767-7901.

WANTED: AVIONICS test equipment. IFR 1200Y3, 401L, 750B, 600A, Also Collins, King, Microline, Proline, Silver, Gold Crown Ground Power Units, Fox Carts. Avionics Plus, 28000 Airport Rd., Box A17, Hangar 97, Punta Gorda, FL 33982. 941-575-0138 P, 941-575-2361 F.

WANTED: BALANCING machines & vibration analyzing equipment manufactured by the following: Spectral Dynamics, Hofmann, Bentley Nevada, Schenck, IRD Mechanical, Gishott. Contact Mike Park at E.T. Balancing, 12823 Athens Way, Los Angeles, CA 90061. 310-538-9738, FAX: 310-538-8273.

DEC EQUIPMENT WANTED!!! We are buying DEC systems, boards, terminals, drives and peripherals. Also Scientific Micro Systems (SMS), DSD, Datability, Dialog, other DEC compatibles, and Computer Output Microfilm (COM) units. Please call for a quote or fax us your equipment list. We buy, sell, and trade. **KEYWAYS, INC.**, 513-847-2300 OR fax 513-847-2350.

WANT USED or surplus DC motor controls or adjustable frequency AC drives, 1/2 HP and up. DC motors fractional to 3 HP. C. Woodruff, 5507 55th Ave. So., Seattle, WA 98118. Voice/Fax 206-723-8487.

WANTED: EARLY audio equipment, amplifiers, pre-amps, tuners, audio tubes, etc. George Schwartz, 18504 Arrowhead, Cleveland, OH 44119. 216-486-6489.

WANTED: TUBES, radios, transmitters, receivers, gyros, bearings, connectors, relays, lamps, synchros. Hyness Company, 709B Delair Road, Cranbury, NJ 08512-4212. Phone: 609-395-1116, FAX 609-395-1117.

MOTOROLA SERIES II, III, & IV CELLULAR MOBILE, CARRY, TOTE, ATTACHE, CAR PHONES. WILL BUY CASH, LOT QUANTITIES ONLY. LB COMPANY, 702-642-3558.

WANTED: LATE MODEL TEST EQUIPMENT Tektronix, HP, Fluke). Especially: Tek SG 505 oscillator plug-in, Tek S-52 pulse generator plug-in. Also, we buy test equipment manuals and catalogs. Pepper Systems: 214-353-0257; 214-902-9511 FAX.

WANTED ERECTOR motor & Gear Box AC Gilbert 1958-1960 series. Channing Smith, 406 Summit, Blytheville, AR 72315.

BBS & ONLINE SERVICES

SECURITY TECHNICAL help online 24 hours a day on the HES BBS via modem: 908-840-6921.

PURE INFORMATION BBS 2400-28.8K 24 hour. 618-949-3898.

ATTN: ADVERTISERS! Blast your ad to millions on the INTERNET at super-low prices. For details and order form, send a self-addressed env. with 55¢ stamp to CNI, POB 251, Norcross, GA 30091. Or dial 703-904-7770 from a FAX and request Document 185. Limited time offer.

INTERNET OPPORTUNITY. Sell old PCs for big \$. Typical system: 286 with hard drive and modem. Call 24 hours 1-800-575-6813 for recorded message.

WE CAN FIND ANYONE! FIND LOST FRIENDS, RELATIVES, ARMY PALS. Send ANY name. Online nationwide search reveals city, state, phone number, mailing address. (Results in 2-DAYS) \$10/name (3/\$25): **BRINKER ENGINEERING LABS**, Suite 121-A, Box 348, Ellaville, GA 31806-0348.

WEB PUBLISHING. Put your business/projects on the internet/web. Low cost, fast results. Order today, be on-line tomorrow. 1-800-575-6816.

EDUCATION

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

ESP, BIOELECTRICITY, microwave hearing introduction comprehensive booklist \$1. Research Associates, PO Box 3583, Boynton Beach, FL 33424-3583.

DON LANCASTER'S ACTIVE FILTER COOKBOOK is back in print. Autographed copies of the seventeenth(!) classic printing \$28.50. **SYNERGETICS PRESS**, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

KNOWLEDGE CARDS. Tables and formulas from math, physics, electronics, engineering and more. Fun and educational. Great Gift. Package \$2. Box 12238, Lexington, KY 40581-2238.

LEARN PC ASSEMBLY LANGUAGE. Disk \$5, Book \$15. ZIPFAST, Box 12238, Lexington, KY 40581-2238.

UNUSUAL TECHNICAL BOOKS, Courses on antique radio repair, camera repair, many other topics! Unusual tools. Free Catalog. **Ed Romney**, Box 487, Drayton, SC 29333. Keep this address! It is hard to find!

MANUFACTURING ENGINEERING BS degree, emphasis in electronic production, Cal Poly in beautiful San Luis Obispo. Interested? Call Professor Mark Cooper at 805-756-2571/mcooper@oobe.calpoly.edu Check out Web http://www.calpoly.edu/~ime400p1/elec_man.html

BUSINESS OPPORTUNITIES

CDROM-600 how-to books, reports, and guides you can reprint and sell. Start own business. LSASE. CDROM, Box 1314NV, Jeffersonville, IN 47131.

THE CASE AGAINST PATENTS. Thoroughly tested and proven alternatives that work in the real world, \$28.50. **SYNERGETICS PRESS**, Box 809-N, Thatcher, AZ 85552. 520-428-4073. Visa/MC.

600 HOW-to-books, reports & guides you can reprint & sell. Complete text of all 600 on Windows CD-ROM. Just \$99. 1-800-862-8000 ext. 361. Visa/MC/COD.

FREE 1996 600,000 items wholesale directory. TNT, Box 2614NV, Big River, CA 92242. (LSASE).

ADVERTISE THE INTERNET reach markets of more than 40 million people USA, Canada and 168 countries for only 24 cents a day. Send \$5, ad writer disk, credit to: Ad placement: PC On-Line Service, PO Box 92128, Warren, MI 48092.

HOME AUTOMATION. Become a dealer in this fast-growing field. Free information. Call, 1-800-838-4051 anytime.

RECOVER PURE gold from old electronic junk and broken scrap jewelry. Free information! Just dial 403-479-6988 from your fax machine to my fax-on-demand and retrieve document #27.

UNIQUE COMPUTER BUSINESS. Simple, home operated. Send \$5 for business pkg. Specify disk size or SASE + \$1 for info. Micro Visibles, 8641 Louis Smith Rd., Borden, IN 47106.

MILITARY COMPONENTS wanted. Capacitors, resistors, diodes, transistors, semiconductors, ICs. Electronic Material Industries, 818-842-5953, FAX: 818-845-3613.

ENTREPRENEURS. GOLDPLATING high profit, low overhead. Find out how you can make hundreds of dollars starting your own business and being your own boss. For more information send SASE to J+T Enterprize, 12460 Crabapple Rd. Suite 202-103, Alpharetta, GA 30201.

COME TO Florida! Profitable electronic service center located in Gainesville, named America's #1 city by Money Magazine. Owner financing with low down payment. Call North Florida Business Brokers, Inc. at 352-378-7663 for details.

DID YOU know Chaffin Electronics offers: Programming service, circuit board manufacturing, thousands of obsolete and hard to find ICs, same day shipping, computerized parts search? Call for more information. Phone: 614-574-4456 or 6906, FAX: 614-574-2124.

PC PARTS WHOLESALE WORLDWIDE. Now you can buy direct from the manufacturers. JUST IMAGINE. 1 GIG HD \$100, MEMORY \$15 a meg, 486-DX4-100MHz motherboards with CPU \$82.50, 14.4 modems \$8, 1.44 FD \$16. LOTS AND LOTS MORE. Need we say more! Our custom software contains our confidential listing of over 300+ computer and parts suppliers worldwide. Complete with phone and fax numbers. Large orders are not required. They'll welcome your business. In addition to our software we have a large printout with proven success from letters required to introduce yourself into this business. The cost of this information is only \$30. If you like, we can send COD. All others outside the USA, please send CK or money order to address. G.R. Stringer, PO Box 30563, Houston, TX 77249-0563. 713-864-3616, Fax 713-880-8321. E-Mail: Rstrin8060@aol.com

WHAT!? YOU don't have the new **TELECODE 20** page **1996 CATALOG!** It's free! 520-782-2316.

START YOUR OWN TECHNICAL VENTURE! Don Lancaster's newly updated **INCREDIBLE SECRET MONEY MACHINE II** tells how. We now have autographed copies of the Guru's underground classic for \$18.50. Synergetics Press, Box 809-K, Thatcher, AZ 85552. 520-428-4073. VISA/MC.

RECEIVE STOCK prices, news, trucking and other info free of monthly fees on TV. Send \$10 and SASE to Electrotec, 2626, W. Parish Ave. #261, Owensboro, KY 42301-3313.

COMPUTERIZED PROGRAMMABLE treadmills: Retail for \$249, only \$65! International Sales & Engineering, seeks sales reps, 1000s of items. No investment! Free information! Info: Ph: 210-350-5555 FAX: 210-350-5574.

BUSINESS OPPORTUNITY "Diamond in the Ruff" Entrepreneur seeks capital investor to develop dynamic embryonic business in telephony/information industry. "Window of Opportunity" is now open for this idea whose time has come. Serious inquiries call GO at 1-800-747-8546.

EARN \$75 per hour cleaning computers. Complete program. LSASE: Cleaning, Box 1056, Jeffersonville, IN 47131.

REPAIRS/SERVICES

PROFESSIONAL LOOKING CAD generated schematics from your hand-drawn circuits. Netlist ready for PCB layout, bill of materials. Send your schematic for a free quote. Fast, accurate, work; no job too small. 516-756-9092.

PRODUCTS DEVELOPED from your concept or design. We provide: electro/mechanical/opto/pneumatic designs. PCB design, fabrication, packaging, tooling, assembly & test. Microcontrollers, custom controls, sensors, smart devices, process automation, scientific research. Call: **A SQUARED TECHNOLOGIES**, 619-432-8285.

PERSONALIZED SCREEN SAVER. We turn your favorite photographs into an eye catching screen saver for Windows. Send 5 photos for \$19.95 (S/H included) along with a check, Money Order, Visa/MC (with exp. date). All photos returned unharmed. (Min. requirements 486SX with 4MB RAM.) Scanning service also available. **SUNCOAST TECHNOLOGIES**, PO Box 5835NV, Spring Hill, FL 34606. Voice/Fax 904-596-7599.

PICS, GALS READ if you've lost your masters. Programming service available. Call for info. Network Sales, 616-683-0500.

The Filter Company

Positive Notch Filters

Large STOCK on all Available Channels

2 thru 24, 95 thru 99

0,1,57,58,59,60,61,A1,A2,A3,A4,A5

ORDER BY SINGLE CHANNELS

We Specialize in Large Quantities on every Channel

PRICES AS LOW AS \$6.00EA

NOBODY BEATS OUR PRICES

Monday - Friday (8am to 5pm) Central Time

QUALITY METAL CYLINDER TYPE NON-TUNABLE

ABSOLUTELY NO DRIFTING PROBLEMS

Standard Positive Filters

1pc-\$16.00 5pcs-\$14.00 10pcs-\$12.00

25pcs-\$10.00 50pcs-\$8.00

Positive "G" Series Filters

1pc-\$30.00 5pcs-\$28.00 10pcs-\$25.00

Tom G. - FL Excellent Service, fast and quick. The only bad thing about this company is they don't sell Cable Boxes. We hope someday they will.....

David P. - CA We called around for help on filters and nobody had any answers except one, call the "THE FILTER COMPANY" we did and had an answer in a matter of minutes.....

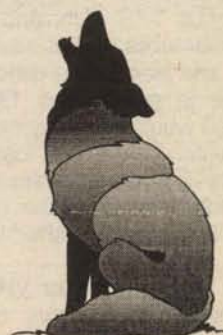
John B. - IL Our company buys in the 100 quantities and needs a large selection of different channels. "The Filter Company" was the only one who was able to supply.....

PHONE & FAX ORDERS:

1-800-235-8080

VISA, MASTERCARD
DISCOVER, UPS COD
CHECKS BY PHONE

Anyone implying theft of Cable Service will be denied assistance
We do not sell Data Blockers,
Bullets or FM Traps !!!!



Give our 800 line a howl for the best service in the Country.....!!!!

A "TFC" Company

17,400 TECHNICAL TIP REPAIRS. Call for an absolutely FREE version of the **TIP PROGRAM. READ ON. VALUABLE, TIME SAVING TECHNICAL REPAIRS** for servicing TVs, VCRs, PROJECTION TVs, CAMCORDERS & other electronics, organized in an easy to use computer program. The **TECHNICAL TIP REPAIR program. PROFESSIONAL BOARD LEVEL & COMPONENT LEVEL REPAIRS** with part numbers, component locations, values & test voltages (when available). ADD your own tips. PRINT tips. Owners of our **COMPUTERIZED TIP PROGRAM** say this is the **BEST** technical tip program on the market today. Works on ANY IBM compatible computer with a hard drive. (Also works on some Apple Macintosh computers.) **NEW VERSION works in DOS and WINDOWS. SPECIAL SALE pricing EXTENDED for March.** Only \$150. **FREE shipping** for prepaid orders (USA). Call for COD. Have your own tips? Ask about our **TIP EXCHANGE** policy with **FREE updates!** Call for an absolutely FREE version of the **TIP program!** Just give us your name, address & phone # and that's it. It's really FREE. **CALL 1-800-215-5081/516-643-7740. HIGHER INTELLIGENCE SOFTWARE, 60 Farmington Lane, Melville, NY 11747.**

EXPERT REPAIRS on all, VCR, home and car stereo equipment. Specializing in 1970s vintage, including tube units. Fast turnaround with 90 P/L warranty. Free estimates. Lowest Rates. 25 years experience. Ship to: Quality Electronics, 197 Stanley Dr., Glastonbury, CT 06033; or call, 860-657-8534.

PCB FABRICATION, PROTOTYPE and PRODUCTION; thru hole, multilayer, SMT. **LASER PHOTOPLOTTING. CAD DESIGN** from schematic or sample PCB. CAD generated schematics. Circuit Applied Technology, 501-967-4070.

AFFORDABLE HP power sensor repair! Most 8481As repaired for \$210 or less. We also handle 478As and many others. Call or fax for more information. Willamette RF, Inc., 503-754-7226, FAX 503-753-4629.

CBTV REPAIR. We specialize in all converters. Give us a call: 405-634-1580.

PINBALL MACHINES! New Catalog! Books, Magazines, Manuals, Diagrams, Supplies, Parts. Send \$2 for catalog Now to: Marco Specialties, Inc., 5290-N Platt Springs Rd., Lexington, SC 29073-9252. 803-957-5500. FAX 803-957-6974. E-Mail: tilt@ix.netcom.com

WANTED: AUDIO components, tubes, catalogs, record cutting lathes, Tektronix 570, tube testers, surplus electronics. I MAKE RECORDS! 612-869-4963.

CABINETS FOR your projects. We are sheet metal fabricators with twenty years experience serving the needs of the electronic and computer industries. Enclosures, brackets, bases, custom made. Hobbyist or manufacturer. One piece or thousands. Send blueprints, sketches and quantity needed for free quote. Larry Hagedorn, 14090 Appleton Ave. NW, Monticello, MN 55362.

TIRED OF IRONING? Prototype service for hobbyists & engineers. Single/small quantity SS PCBs. No setup fee. \$10 minimum, most boards \$25. We scan magazine artwork free so get out your back issues! For details, write or call: **FIRST PROTO**, 4201 University Drive, #102, Durham, NC 27707. 919-403-8243.

KITS BUILT 1 to 1000. Wirewrap, breadboard, thru-hole, SMT PCB assembly. Wiring, cables, harness, chassis, racks, panels. Custom test fixtures. Quick turnaround. Low rates, top quality, free quotes. Call: **A SQUARED TECHNOLOGIES, 619-432-8285.**

(E)EPROM PROGRAMMING done quickly and economically. One day turn around typical. Simple copy \$2.50 per device. Also prototyping, design, and consulting services available. Call or send SASE to: **Luzer Electronics, 4023 North Bayberry, Wichita, KS 67226. 316-687-4759, FAX 316-687-3103.**

PRODUCT/CIRCUIT development available with 18 years experience. Specializing in RF, analog and digital design of satellite, PCS, microwave, audio, power and video equipment. Microprocessor based controller design using 68HC11, 8051 and 8048 processors. Have complete microwave and digital development lab for product development. SMT and through-hole PCB design services available. Call for references and capabilities. Tom Hajjar, 543 W. Amherst Cir., Satellite Beach, FL 32937. 407-773-5633.

PROTOTYPE PCB SERVICE LOWER YOUR PRODUCTION COST. Single double sided/SMT/PTH. Electro Tin lead plate/reflow. CAD design single to multilayer. Pen and laser plotting. Quote within 24 hours. Gerber file modern transfer accepted. **RTR DESIGN, INC., 1008 Falls Rd., Parkton, MD 21120. Voice/Fax 410-357-5013. 8:00am-4:30pm EST.**

Continued from page 59

TECH FORUM

it saves space and can sometimes be more cost effective. If you're running a business, however, it could be devastating if something were to go wrong with it. You'd be without the said functions until you can get the unit replaced or repaired.

**Brandon Etto
Austintown, OH**

ANSWER TO #29613 - FEB. 1996

The answer depends upon many things: Is the old TV antenna a VHF/UHF, or a VHF only? Do you want to get up on the roof and modify the antenna in any way? Does it have an operating rotor? Does the antenna have any corrosion, and what is the condition and length of the feedline?

Several uses come to mind that don't require any modifications.

Use it as a long-distance FM broadcast reception antenna. Usually such antennas are very good at FM, even if they were not originally designed to receive FM broadcasts. A rotor would be a definite plus in this application.

To have any hope of extending a 900 MHz cordless phone, the antenna must have UHF capabilities. If so, the antenna would probably work very well at 900 MHz. However, the beam of a large antenna is apt to be quite directional, so the roaming direction for the 900 MHz phone would be very narrow. This would not be in technical compliance with the original FCC regulation concerning radiated signal strength. If you wish to modify the antenna, find the shortest UHF element, measure it, subtract about 1/2 inch, and cut all other UHF elements to that size. In this application, the length and condition of the feedline is paramount. Old 300 ohm twinlead would probably make any antenna performance be lost. Even replacement 300 ohm twinlead is still lossy. Consider replacing the twinlead with foam-filled coax or other low-loss coax.

Do you wish to monitor VHF/UHF scanner traffic? If so, this antenna would be worth a try. Sometimes height can make up for a lot of other inefficiencies. Performance on VHF public service bands might be accept-

able; on UHF it probably would be fine. Again, a rotor would be a plus, and you could monitor services normally considered outside of the usual scanner range.

You could tie both ends of the feedline together and use the entire antenna and feedline as an external antenna for an AM receiver. If your AM receiver doesn't have an external antenna connection, a few loops of wire near the internal loopstick can do wonders. Tie one end of the loops to the feedline, the other end to a ground, such as a water pipe.

Are you a shortwave radio listener? Same trick as above, except most shortwave radios have provisions for external antenna connections.

Other things to consider are the condition of the antenna itself and the 300-ohm feedline. If the antenna is well worn and rife with corrosion, you will probably pick up more noise than signal. Same applies to the feedline. Remember that TV stations run from 100 KW to 2 MW, so receiving deficiencies can be overwhelmed. Public services and other users run a few hundred watts at most. Hope this gives you some ideas.

**Gary Bishop
Marion, IA**

ANSWER TO #2964 - FEB. 1996

The MS-2 is an early synthesized scanner that covered 31.18 to 50 MHz (low band), 151.18 to 170 MHz (high band), and 451.18 to 470 MHz (UHF band). Here is a procedure to allow you to compute frequency codes and program it.

1. Subtract 31.18 MHz from a low-band frequency, 151.18 MHz from a high-band frequency, or 451.18 MHz from a UHF frequency you wish to program.

2. Divide the result you got in step 1 by .005 and round off to the nearest whole number. This should give you a number between 0 and 3764.

3. Convert the result you got in step 2 to a hexadecimal number. This should give you a number between 0 and EB4. This is more easily done if you have a calculator that can make base 10 to hexadecimal conversions.

4. Convert the step 3 result to a 12-digit binary number, using leading zeros if necessary. This should give you a number between 0000 0000 0000 and 1110 1011 0100.

5. Put a binary 0000 for low band, 0010 for high band, or 0001 for UHF band to the left of the step 4 result.

6. Press the scanner's SCAN/MANUAL button in to stop the unit from scanning.

7. Advance to the channel you want to program using the CHANNEL SELECT button.

8. Press the PROGRAM button in.

9. Enter the 16-digit code for the desired frequency by pressing the 0 and 1 buttons in the exact order that the code is written, left to right.

10. Release the PROGRAM button and then press it in again; if the lamps light in the correct sequence, the code has been entered correctly in the memory.

11. If you see that the code has been entered correctly, release the PROGRAM button.

12. Advance to the next channel to be programmed using the CHANNEL SELECT button. Repeat steps 1 through 12.

**Ron Wing
Wichita, KS**

ANSWER TO #29614 - FEB. 1996

Yes, there are many manufacturers of lasers with varying size and power levels to do your job. There are low-power lasers that are delicate enough to cut tissue paper, and high-power lasers that will cut through six inches of cold steel. If you intend to cut through single layers of cloth, and the cutting rate (feet per minute) isn't a large consideration, then a moderate size laser of around 20 watts should do the job. If you intend to cut multiple layers of cloth, at very high rates of feed, you may need a laser of around 60 to 75 five watts to do this job. The question you have to ask yourself is, "What are my requirements and how much do I want to spend?" You have to choose between cost and efficiency. If your budget will permit, you can purchase a brand new variable power, ND/YAG laser from such companies

as Lumonics, and set this up on a milling machine bed, complete with CNC mirror controls, and cut through dozens of feet of multiple layer cloth at a time.

Expect this type of setup with a 100 watt laser, CNC mirror controls, computer, and a small used Bridgeport milling machine (manual type controls) to cost you around \$75,000.00. You will still have to do the modifications yourself to fit the laser onto the milling machine, or your assembly line table. This setup has a CNC controlled mirror on the head of the laser and will cut out patterns that you program into the 486 computer. You must also purchase separate software and educate yourself how to program and use the machinery. The Department of Radiology and OSHA require that you build around the laser work area.

A safe work environment includes shielding from the light to any passers-by, and exhaust fans for the operator, depending on the toxicity of the vaporized material.

If all this cost is not what you had in mind, then you will have to assemble a laser from second hand parts and build a smaller and simpler version. You will need the help of a good machinist, a mechanic, and an electronic hobbyist if you are to keep the price down. You should be able to assemble a modest low-power cutting laser, complete with bed and feed, for probably under \$5,000.00, depending on who and what you know. Expect to pay at the very least around \$15,000.00 if you have no knowledge or associates who can help you in this endeavor.

You can purchase a modest YAG laser for about \$1,500.00 for parts only, or a fully assembled unit for considerably more. You will need to have a fully adjustable power supply complete with pulse width and repetition rate for the laser. You may have to manufacture a cooling system depending on how large your laser is and what settings you will be running it at. Overheating the laser assembly will damage it permanently and replacement heads are expensive. You can purchase an old Bridgeport milling

machine table, with manual feed, for less than \$1,000.00 and modify it with simple CNC controls. (See *Nuts & Volts* Nov. '94 issue for CNC controls.) The bed of the milling machine will move instead of having a motorized mirror assembly. However, you can purchase a complete CNC controlled mirror assembly, but don't expect to get one for under a couple thousand dollars new. If you shop around, you might be able to purchase a used assembly that has the correct mirror coating, or you can have it refurbished to suit your laser frequency. If you intend to use any CNC controlling at all, either on the bed assembly, or a more expensive mirror head, you will need, at the very least, an 8088 or a 286 computer. You should be able to purchase one of these computers second hand for around \$100.00. You can buy surplus stepper motors for \$5.00 to \$10.00. Homemade wiring should be less than \$10.00, and a back copy of *Nuts & Volts Magazine* will get you started. The other parts are minor, and the whole CNC assembly should cost you less than \$250.00.

The advantage of the YAG laser over a gas laser, especially on cloth, is that it uses short hot pulses which can be adjusted to vaporize holes through the material and yet cool off between pulses so the cloth doesn't smolder or catch fire. You vaporize and cool hundreds of times per second depending on your settings and thickness of cloth. Balancing the feed rate of your table and the pulse rate of the laser will allow a clean cut while reducing the risk of fire to the cloth. You can use a carbon dioxide laser, but this approach increases the overall cost and risk of fire.

There are at least a couple of dozen used laser dealers advertising throughout the country, and some of them advertise in *Nuts & Volts*. Meredith, MWK, and Midwest to name a few. The final cost of building a small laser cutting assembly will vary greatly depending on your knowledge and skills.

**Chris
Beiber, CA**

ANSWER TO #1962 - JAN. 1996

Public safety officials operate on certain channels, or frequencies, just like you tune in certain channels on your TV. All modern scanners can be programmed with these frequencies by punching in the frequency on the keypad, much like dialing a telephone. Your Bearcat scanner is crystal-controlled, which means you must buy a crystal for each frequency you want to listen to. When you moved, you discovered that officials in your new town are operating on different frequencies than your old town, since you can't hear anything. To find out these frequencies, visit your local scanner dealer and ask for a sheet of local frequencies. Sometimes they have these printed out and will give them to you free. If not, go to Radio Shack and buy the Michigan/Ohio edition of "Police Call." You could also join the Bearcat Radio Club at 1-800-423-1331 or U.S. Scanner News at 1-800-890-6999, both of which publish scanning newsletters and frequency lists.

Now that you know what frequen-

cies you wish to listen to, you must open up your radio and see which boards are installed in it. There are three boards available: 30-50 MHz, 150-174 MHz, and 400-512 MHz. They are usually labeled, or you can notice which module the current crystals are plugged into. There is only room for two boards, module A and module B. If your scanner has only one board installed, you may have difficulty finding another one. Another problem is that many public safety agencies are moving to 800 MHz. If this is the case in your area, or they are using frequencies other than the ones covered by your boards, you are out of luck since your scanner cannot receive these frequencies. If all these problems are solved, now you are ready for new crystals. Your local Radio Shack can order them for you, or try Jan Crystals, P.O. Box 60017, Ft. Myers, FL 33906, 1-800-526-9825. Now you can remove your old crystals and plug in your new ones.

As for service and parts, Bearcat was purchased by Uniden. Write Uniden Parts Dept., 9900 Westpoint Dr., Indianapolis, IN 46250 or call 1-800-297-1023. Your scanner will not quite achieve the sensitivity and selectivity of today's scanners, but I feel the sound quality and volume of your Bearcat to be superior.

Finally, you must consider economics. At \$5.00 a pop for crystals from Radio Shack for eight channels, that's \$40.00. If your scanner needs parts, repairs, or another board, that's more money. You still have only eight channels, and cannot search for new frequencies or reprogram your channels at the touch of a button. I have seen 60-channel scanners on sale for as low as \$120.00. Keep in mind that most cheaper scanners do not cover 800 MHz, but you may not need that coverage if 800 MHz is not being used in your area. If your crystal and repair costs approach \$80.00 to \$100.00, I would advise you to put that money toward a new scanner unless you are terribly attached to this one or just want the satisfaction of owning a piece of vintage gear.

**Steven Vail
Martinsville, IN**

ANSWER TO #29620 - FEB. 1996

Your battery charger connected to the 240-volt line should not be returned through the "ground" wiring. The ground is the green wire, and is connected to the frame or metal box holding the charger. This is to protect you so that when you touch the metal box, you can never get shocked as it is already grounded. No current must ever flow through this connection. Power is supplied from the "hot" side of the line, through a circuit breaker, and then through your charging apparatus, and returning back to the "common" side of the line which is the white wire.

If your machinery uses considerable current, the circuit breaker is rated at more amperes, i.e., instead of 15 amps, it's rated at 20 or 30 amperes, and the wiring is also of a higher gauge. An electric stove takes a 60-amp breaker, and the wiring is 8/0 gauge, returning to the "common," not the "ground!" Even though these two

eventually come together in your electric box, they are separate circuits and should not be confused as one.

**Joe Kish
Clackamas, OR**

ANSWERS TO #2969 - FEB. 1996

Question #2

The second question involves the use of the true name function in a batch file. Try this:

```
truname | find ">xyzzy.1
echo set pathname=>xyzzy.2
copy xyzzy.2+xyzzy.1 xyzzy.bat
call xyzzy
del xyzzy.*
```

Then use the variable %pathname% anywhere you need the original path of the disk. This assumes that pathname and xyzzy are available and are not used by other programs, and that the current path is writable. If the desire is to be able to change to another drive and directory and then change back, then there is a simpler way. There are two programs called pushdir and popdir that allow you to set the current directory out into memory and then come back to it as desired.

**Ray Todd Stevens
Bedford, IN**

ANSWER TO #29616 - FEB. 1996

The answer to your question is, no. It's not practical or cost-effective to try and convert a 400 cycle 440 volt generator to the lower and less efficient voltage and cycles that you require. There are many things you can do to achieve your goal, but all of them would be very costly. It might be cheaper in the long run to purchase a new or used 220 volt/60 cycle generator frame and install it to your unit. The inexpensive way to achieve 120/240 single phase out of your generator will cause a loss of power so great that you will end up with only a 2,000 watts — maybe — out of the 35,000 watts

that you started with, and not without problems. If you add a gear reduction to the generator of 6.66 to 1, you will achieve 60 cycles, but your voltage will drop drastically to around 66 volts or less, and the current will also drop drastically to probably less than 5,000 watts theoretical. Running the generator at the slower cycle will overheat the windings because they were wound with a specific impedance in mind, allowing the wire size to be reduced for weight and efficiency. The whole purpose of 400 cycles is that you can achieve more power from less size and weight. You may not even be able to run it at half this current because of overheating and the output of the unit is still three phase. You will still have to add a very large and expensive three-phase transformer just to convert it back to single phase. I don't know if a standard transformer exists to convert the 66 volts up to 240 volts, and again; this just isn't practical. The voltage regulation system on the generator also will be effected by the low voltage and might drop out altogether and lose its control over the windings. Then you have the problem of the cycle regulator which will have to be replaced to keep the motor running at the exact RPM necessary to maintain 60 cycles. They generally sense the output of the generator in cycles, and then they manually control the motor speed to maintain the desired cycles. There are just too many losses with this approach and it may end up costing you more in the long run by burning out the windings.

This generator is still very useful for resistive loads such as lighting and heating with no modifications necessary, and you might consider trading it with someone who has that need, such as search and rescue, fire department, or construction lighting.

**Chris
Beiber, CA**

ANSWER TO #2962 - FEB. 1996

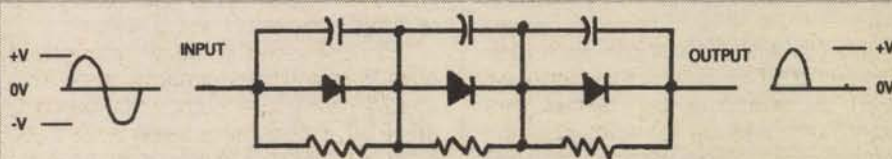
Question #1

Check out an older edition of the *ARRL Radio Amateur's Handbook* and you'll see that series diode stacks were often used in high voltage supplies for linear amplifiers. This increases the peak inverse voltage (PIV) of the rectifier by a factor equal to the number of diodes in the stack. You must be careful when you series-connect rectifier diodes because each diode can exhibit a different reverse resistance when reverse-biased. If you have four 600-volt PIV diodes in series that must withstand 2000 volts PIV and one of the diodes has an exceptionally high reverse resistance compared to the other three, it would drop the bulk of the reverse voltage, exceed the individual diode's PIV rating and be destroyed. To prevent this, put a high-value resistor (10MW is a good start) in parallel with each diode to distribute the reverse voltage across each diode. The reverse leakage current this creates is minimal

in most applications. Reverse voltage spikes can also cause problems in stacked rectifier circuits. A 0.01µf disc ceramic capacitor in parallel with each diode will prevent spike damage. Make sure that the voltage rating of the capacitor is greater than the PIV of the diode.

As a side note, you'll find that there are rectifiers out there that are rated for high PIVs, e.g., 5 KV (Tektronix uses them a lot in oscilloscope high-voltage supplies). Internally, there are two or more diodes in series to withstand the higher PIV. If you don't know that little tidbit of information, a check with most ohmmeters will falsely indicate the rectifier to be open because the meter's battery is unable to forward bias two or more diode junctions. They have to be tested with an older meter that used a higher-voltage battery, in a circuit that will forward bias the diode or with a semiconductor curve tracer.

**Dean Huster
Oklahoma City, OK**



HOW TO PLACE A CLASSIFIED AD

TYPE or PRINT your **ELECTRONICALLY RELATED** ad copy **CLEARLY** (not all caps) on a separate piece of paper. Spell out words when submitting handwritten copy. Calculate the number of words and multiply it by the appropriate rate (see RATE PER WORD section). Include any charges for bold and/or CAPPED words, any artwork costs that would be applicable, and/or costs for boxing your ad (explained below). Choose the appropriate classification for your ad(s) to appear in (see below). If no classification is indicated, it will be placed in Misc. Electronics or wherever we deem most suitable. **Enclose your name, address, phone number, and Nuts & Volts account number from your mailing label** (if available) for identification purposes. Include full payment — **CLASSIFIEDS RUN ON A PRE-PAID BASIS ONLY** — and mail your completed order to:

NUTS & VOLTS MAGAZINE, 430 Princeland Ct., Corona, CA 91719.

RATE PER WORD

The ad rate for **current PAID subscribers** is **60¢** per word. All others pay **\$1.20** per word. There is a **\$9.00 minimum** charge per ad per insertion.

WORDS IN BOLD AND/OR ALL CAPS

Words to be set in **bold** or CAPS are each **10¢** extra PER WORD. **BOLD CAPS** are **20¢** extra per word. The first two words of each ad are bold capped at no charge. Indicate bold words by underlining. Words normally written in caps (e.g., IBM) and accepted abbreviations such as VAC or MHz are NOT charged as all cap words. Use a two-letter abbreviation for states.

PHOTOS, DRAWINGS, AND BOXES

A photo or drawing may be run at the top of your classified ad for an additional **\$10.00** (1" depth max.) for camera-ready art. No wording is allowed in this area. Add a one-time charge of **\$5.00** to enlarge, reduce, or duplicate

line art, or **\$8.00** for halftone of photographs. To **BOX** your ad, include an additional **\$50.00** for copy-only ads, or **\$75.00** for ads with art or photos.

FAXING IN AD COPY

You may fax in ad copy or changes before the closing date (5:00pm on the 10th) at 909-371-3052 using MasterCard or Visa. Include credit card expiration date, the name that appears on the card, a daytime phone number, and your Nuts & Volts account number. Ads without credit card information will not be listed as received until payment is received in full. **WE DO NOT CALL OR FAX BACK VERIFICATION OR QUOTES OF FAXED-IN ADS.** For verification of faxed-in ads, please call 909-371-8497.

DEADLINE

Prepaid ads received by 5:00pm on the closing date (10th of the month) will appear in the following month's issue. Ads postmarked through the 10th, but received after the closing date, will be placed in the next available issue. No cancellations or changes after the 10th. Cancellations and changes must be submitted in writing.

IMPORTANT INFORMATION

All classified ads are running copy only. No special positioning, centering, dot leaders, extra space, etc. is allowed. All advertising in Nuts & Volts is limited to **electronically related items ONLY**. All ads are subject to approval by the publisher. We reserve the right to reject or edit any ad submitted. We do not take ad copy or changes over the phone. We do not bill for classified ads. Repeat ads or ads run in multiple classifications within the same issue are allowed. Paid subscribers may run ads at the 60¢ rate only through their subscription expiration date. **NO REFUNDS.** Credit only. No credit for type-setting errors will be issued unless you *clearly* print or type your ad copy.

Choose a category for your ad from the classifications listed below.

10. Ham Gear For Sale	80. Test Equipment	120. Components	155. Manuals/Schematics Wanted
20. Ham Gear Wanted	85. Security	125. Microcontrollers	160. Misc. Electronics For Sale
30. CB/Scanners	90. Satellite Equipment	130. Antique Electronics	170. Misc. Electronics Wanted
40. Music & Accessories	95. Military Surplus Electronics	135. Aviation Electronics	175. BBS & Online Services
50. Computer Hardware	100. Audio/Video/Lasers	140. Publications	180. Education
60. Computer Software	110. Cable TV	145. Robotics	190. Business Opportunities
70. Computer Equipment Wanted	115. Telephone/Fax	150. Plans/Kits/Schematics	200. Repairs/Service

ADVERTISER'S INDEX

ABC Electronics	50	Consumertronics	89	MCM Electronics	22	Scott Edwards Electronics	80
ACP Super Store	60	Converters, LTD.	50	MD Electronics	77, 122	Skycraft Parts & Surplus, Inc.	54
Add-On America Corp.	77	Copper Electronics	48	MDM Radio, Ltd.	43	Solar Electric, Inc.	97
Advanced Educational Systems	83	Crazy Bob's	57	Memory Masters, Inc.	75	Software Clearance Outlet	22
Ah-Ha! Design Group, Inc.	19	CSI	37	Metric Equipment Sales, Inc.	79	Southern Electronics	31
Alfa Electronics	21	Cunard Associates	6	MHZ Electronics, Inc.	87	SPI Semiconductor	49
Aljon Technologies, Inc.	50	DBS Satellite	112	MicroCom Industries, Inc.	88	Square 1 Electronics	53
All Electronics Corp.	61	Danbar Sales Company	38	Mis-Cyn Electronics	82	Starlite Electronics	14
All Phase Video-Security, Inc.	29	Dexis	89	Motron Electronics	109	SUPERCIRCUITS	68
Allison Technology Corp.	69	Digicom Communications, Inc.	20	Mouser Electronics	56	Synergetics	65
Alltech Electronics Co.	30	Direct Cable Supply	105	Mr. NiCd	56	Syntax	47
Alltronics	28	Dominator Technologies, Inc.	111	MWK Industries	31	Technological Arts	80
American Innovations, Inc.	20	Earth Computer Technologies	43	National Cable Services	57	Televue Distributors	62
American Trap Company	17	E.H. Yost and Company	56	Netcom	17	Test Equipment Sales	49
Andromeda Research	6	Electro Tool, Inc.	19	Northeast Electronics, Inc.	68	The Filter Company, Inc.	117
AP Circuits	12	Electronic Emporium, Inc.	11	Novaplex	15	The Greater Baltimore Hamboree and Computerfest	77
Ar ² Communications Products	69	Electronic Rainbow, Inc.	39	One Stop Supplier	96	The Halcyon Group	22
Asset Sales, Inc.	57	EMAC, Inc.	5	Optoelectronics	123	The M.O.O. Corp.	87
B & S Sales	81	Gateway Electronics, Inc.	98	Parallax, Inc.	Back Cover	The RF Connection	67
Basic Electrical Supply & Warehousing Corp.	111	General Device Instruments	13	ParaMax, Inc.	29	Timeless Products	113
Battery-Tech, Inc.	91	Greenleaf Electronics	63	Phelps Instruments	37	TNR Technical, Inc.	97
Baylin Publications	70	Halted Specialties Co.	3	Picotronic	75	Trenton Computer Festival	13
Bel Merit	6	Hameg, Inc.	75	Plazac Sales, Inc.	60	Tucker Electronics & Computers	2
Berger's Electronics	82	Hi-Q Products, Inc.	6	PM Electronics	73	UCANDO Videos	68
Bisme Computer, Inc.	14	H.T. Orr Computer Supplies	54	Polaris Industries	83	Ultimate Cable	32-33
Brigar Electronics, Inc.	51	Index Publishing Group, Inc.	11	Prime Electronic Components, Inc.	90	VersaTech Electronics	13
BWC Company, Inc.	31	Information Unlimited	76	Protocol Electronics	108	Video Connection, Inc.	19
C & H Sales Co.	49	International Microelectronics	69	QB Video	29	Vision & Motion Surplus	97
C & S Sales, Inc.	55, 99	I. S., Inc.	18	Quality Electronics	67	Vision Specialties	48
CA Grapevine	48	Intronics, Inc.	60	R & S Surplus	12	Visitect, Inc.	73
Capital Electronics, Inc.	10	J & M Microtek, Inc.	20	Radio School	100	Visual Communications, Inc.	70
Cardservice International	54	Jade Products, Inc.	53	RA Enterprises	101	Western Test Systems	40-41
Cellular Technology Group	64	Javanco	91	Resources Un-Ltd.	71	Wheatstone Microsystems, Inc.	82
Cheneko Products, Inc.	20	KDE Electronics, Inc.	103	RF Parts	17	White-Star Electronics	91
CFS Electronics	43	Koll-Dove	74	Roger's Systems Specialist	110	Wholesale Cable	82
CME, Inc.	56	La Paz Electronics Int'l.	13	S & N Cellular	104	Xandi Electronics, Inc.	87
Communications Systems Laboratories 43		M ² L Electronics	74	SC Engineering	18	Xtreme Electronics	74
		Master Components	11				

ADVERTISER'S INDEX

**NEW
INDEX!**

Find what you need by
product/category.

AMATEUR RADIO & TV

Aljon Technologies, Inc.	50
Copper Electronics	48
Radio School	100
Jade Products, Inc.	53

BATTERIES/CHARGERS

All Electronics Corp.	61
Battery-Tech, Inc.	91
Cunard Associates	6
E.H. Yost and Company	56
Jade Products	53
Mr. NiCd	56
TNR Technical, Inc.	97

BUYING ELECTRONIC SURPLUS

Dexis	89
SPI Semiconductor	49
Memory Masters, Inc.	75
Metric Equipment Sales, Inc.	79
MHZ Electronics, Inc.	87
Skycraft Parts & Surplus, Inc.	54

CABLE TV

American Trap Company	17
B & S Sales	81
Basic Electrical Supply & Warehousing Corp.	111
CFS Electronics	43
Converters, LTD.	50
Digicom Communications, Inc.	20
Direct Cable Supply	105
Greenleaf Electronics	63
I. S., Inc.	18
KDE Electronics, Inc.	103
Master Components	11
MD Electronics	77, 122
MicroCom Industries, Inc.	88
National Cable Services	57
Northeast Electronics, Inc.	68
Novaplex	15
One Stop Supplier	96
Plazac Sales	60
PM Electronics	73
Protocol	108
QB Video	29
Quality Electronics	67
Southern Electronics	31
Starlite Electronics	14
Syntax	47
Televue Distributors	62
The Filter Company, Inc.	117
The Halcyon Group	22
Timeless Products	113
Ultimate Cable	32-33
Video Connection, Inc.	19
Vision Specialties	48
Visual Communications, Inc.	70
White-Star Electronics	91
Wholesale Cable	82
Xtreme Electronics	74

CB/SCANNERS

Index Publishing Group, Inc.	11
Optoelectronics	123

CCD CAMERAS/VIDEO

All Phase Video-Security, Inc.	29
CME, Inc.	56
Communications Systems Labs	43
Hi-Q Products, Inc.	6
Picotronic	75
Polaris Industries	83
Resources Un-Ltd.	71
SUPERCIRCUITS	68

COMPONENTS

Alltronics	28
Brigar Electronics, Inc.	51
Electronic Emporium, Inc.	11
International Microelectronics	69
Javanco	91
Mis-Cyn Electronics	82
Picotronic	75
RF Parts	17
Skycraft Parts & Surplus, Inc.	54
The M.O.O. Corp.	87

COMPUTER

Hardware

Add-On America Corp.	77
Alltech Electronics Co.	30
Bisme Computer, Inc.	14
BWC Company, Inc.	31
Earth Computer Technologies	43
Halted Specialties Co.	3
La Paz Electronics Int'l.	13
Prime Electronic Components, Inc.	90
RA Enterprises	101

Software

Ah-Ha! Design Group, Inc.	19
Crazy Bob's	57
Software Clearance Outlet	22

Microcontrollers/IO Boards

Advanced Educational Systems	83
BWC Company, Inc.	31
EMAC, Inc.	5
J&M Microtek, Inc.	20
Motron Electronics	109
Parallax, Inc.	Back Cover
Paramax, Inc.	29
SC Engineering	18
Scott Edwards Electronics	80
Square 1 Electronics	53
Technological Arts	80
VersaTech Electronics	13
Wheatstone Microsystems, Inc.	82

Printer Supplies

Add-On America Corp.	77
Chenesko Products	20
H.T. Orr Computer Supplies	54

DESIGN/ENGINEERING/ SERVICES

AP Circuits	12
Capitol Electronics	10

EDUCATION

Advanced Educational Systems	83
EMAC, Inc.	5
Radio School	100
Square 1 Electronics	53
UCANDO Videos	68

EPROM PROGRAMMERS

Andromeda Research	6
General Device Instruments	13
Intronics, Inc.	60
M ² L Electronics	74

EVENTS/SHOWS

ACP Super Store	60
Koll-Dove	74
The Greater Baltimore Hamboree & Computerfest	77
Trenton Computer Festival	13

KITS

Berger's Electronics	82
Electronic Rainbow	39
Gateway Electronics, Inc.	98
Scott Edwards Electronics	80
Visitect, Inc.	73
Xandi Electronics, Inc.	87

LASERS

Hi-Q Products, Inc.	6
MWK Industries	31

MISC/SURPLUS

Aljon Technologies, Inc.	50
All Electronics Corp.	61
Alltronics	28
Brigar Electronics, Inc.	51
Cardservice International	54
Earth Computer Technologies	43
Electronic Rainbow	39
Gateway Electronics, Inc.	98
Halted Specialties Co.	3
Information Unlimited	76
International Microelectronics	69
Javanco	91
MDM Radio	43
Picotronic	75
Prime Electronic Components, Inc.	90
RA Enterprises	101
Roger's Systems Specialist, Inc.	110
Skycraft Parts & Surplus, Inc.	54
Vision & Motion Surplus	97

PUBLICATIONS

Baylin Publications	70
Consumertronics	89
Index Publishing Group, Inc.	11
MCM Electronics	22
Mouser Electronics	56
Netcom	17
Synergetics	65

SATELLITE

Baylin Publications	70
DBS Satellite	112

SECURITY

All Phase Video-Security, Inc.	29
American Innovations, Inc.	20
Ar ² Communications Products	69
CME, Inc.	56
Communications Systems Labs	43
Dominator Technologies, Inc.	111
Electronic Rainbow	39
Polaris Industries	83
SUPERCIRCUITS	68
Visitect, Inc.	73

SOLAR EQUIPMENT

Gateway Electronics, Inc.	98
Jade Products	53
Solar Electric	97

TELEPHONE/CELLULAR

American Innovations, Inc.	20
Ar ² Communications Products	69
CA Grapevine	48
Cellular Technology Group	64
CSI	37
S & N Cellular	104

TEST EQUIPMENT

ABC Electronics	50
Alfa Electronics	21
Allison Technology Corp.	69
Asset Sales, Inc.	57
Bel Merit	6
C & H Sales Co.	49
C & S Sales, Inc.	55, 99
Danbar Sales Company	38
Dexis	89
Electro Tool, Inc.	19
Hameg, Inc.	75
Metric Equipment Sales, Inc.	79
MHZ Electronics, Inc.	87
Optoelectronics	123
Phelps Instruments	37
R & S Surplus	12
Test Equipment Sales	49
Tucker Electronics & Computers	2
Vision & Motion Surplus	97
Western Test Systems	40-41

TOOLS

Alltronics	28
Tucker Electronics & Computers	2
Electro Tool, Inc.	19
Vision Specialties	48
Roger's Systems Specialist, Inc.	110
White-Star Electronics	91

WIRE/CABLE & CONNECTORS

All Electronics Corp.	61
Brigar Electronics, Inc.	51
The RF Connection	67
Roger's Systems Specialist, Inc.	110

Use
this new index-
by-product to find
what you need
FAST!

**The Rules
Have
Changed!**

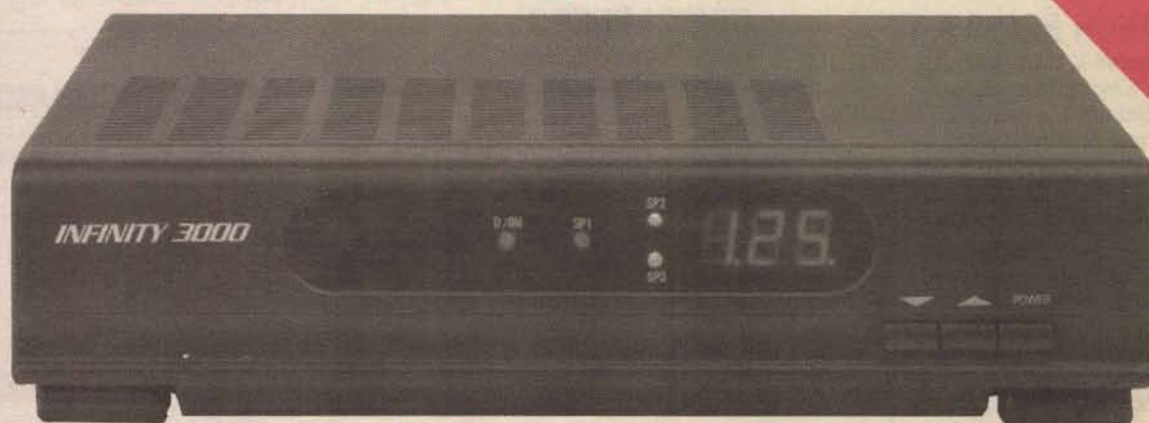
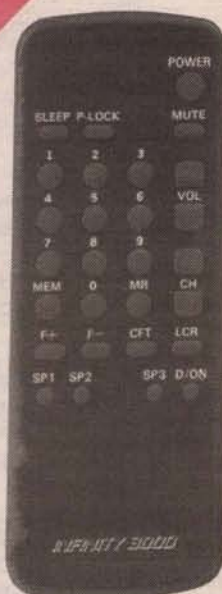
The New INFINITY 3000

**It's A
Revolutionary
Idea In Video
Electronics!**

Suggested Retail

\$349.00

One-year Warranty

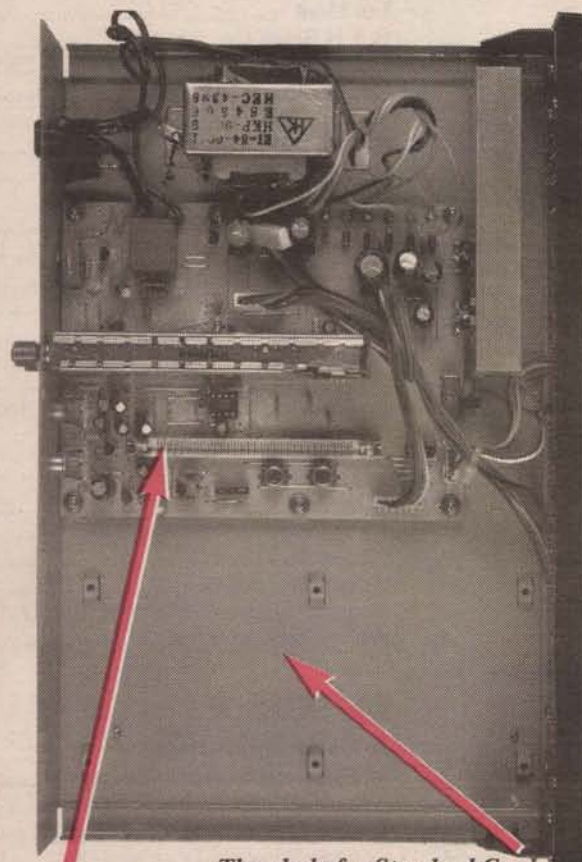


CALL FOR DEALER PRICING TODAY!

1-800-820-1998



First With.....



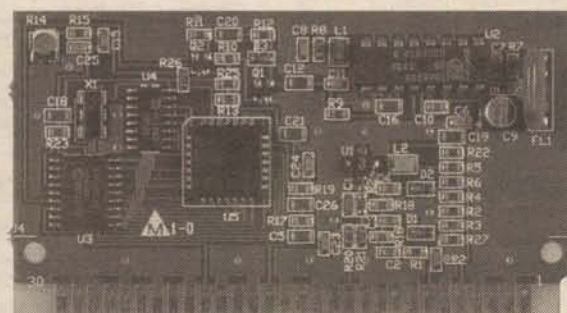
Thru hole for Standard Card
Simm Socket for Micro Card

125 Channel Selection

As your cable company grows so will you, the Infinity 3000 is one of the first converters to offer 125 channel/800 Mhz viewing. Don't settle for anything less than 125 channel capacity... unless of course you like watching a blank screen.

Dynamic Memory

Only the Everquest line offers Dynamic Memory Recall. Put your favorite channel settings in Dynamic Memory and never worry about them again. Dynamic memory will recall the settings automatically.



Upgradeable Micro Card

Upgradeable Card Slot

Now no matter where you go or what system your cable company uses, you're ready to adapt. Only the Infinity 3000 gives you the modular flexibility to pop out one card and replace it with another in a matter of minutes. (Accepts both standard and micro simm cards.)

Advanced Parental Control

Only Everquest offers non-volatile A.P.C. which will unlock all your parentally controlled channels with a four digit personal code and automatically relock them when you shut the unit off.

Optional Programmability

Only Everquest offers an Optional Programmable feature to Cable Operators. Call for details.

Don't get left behind with inferior equipment that can't grow with you. Prepare yourself for the future with UPGRADEABLE TECHNOLOGY from Everquest.

Additional Features include:

- Audio/Video Ports
- 3/4 Switchable
- Sleep Timer
- HRC/STD/IRC Switchable
- Last Channel Recall
- Favorite Channel Memory
- Volume Control/Mute
- Automatic Fine Tuning

EVERQUEST

5723 F Street • Omaha, NE 68127

Phone: 402-734-3641

FAX: 402-734-4250

Monday - Friday: 8:00 am - 6:00 pm

Capture the action!

Don't Miss Out!!

Purchase a Scout for only \$449.00
& Receive Free:
• DB32 Mini Antenna
• CC30 Carry Case
• Spectrum FCC CD
Total package value \$526.00
For only \$449.00
LIMITED TIME ONLY!!

\$449

Scout® Reaction Tune®

brings you all the action. Whether it is police, fire, commercial or just everyday communications monitoring, the Scout will bring you closer to the action. The Scout will not only capture the frequency, but it automatically tunes the receiver to that frequency at the same time; (see receivers appl. below). Let the Scout Reaction Tune your way into the world of communications.

FEATURES

- Records up to 400 unique frequencies in memory.
- Records up to 255 hits on each frequency in memory.
- 10MHz - 1.4GHz single frequency range.
- Records frequencies automatically with Patented Digital Auto Filter & Digital Auto Capture.
- Reaction Tune the AOR AR8000, AR2700, ICOM R7000, R7100, R9000, Radio Shack Pro 2005/2006 with OS456 installed, and the Radio Shack Pro 2035/2042 with OS535 installed.
- All frequencies are automatically saved until deleted.
- Interface to a PC with the optional **OPTOLINX** or **CX12AR** for data download.
- Custom 10 digit LCD display with automatic EL backlighting.
- 16 segment RF signal strength bargraph.
- Pager style vibrator for discreet recording. Distinctive beeper indicates frequency detection.
- Rapid charge NiCads with AC charger supplied; 2 hour recharge and 8-10 hour battery discharge.

SPECS

Frequency Range: 10MHz - 1.4GHz
Input Amplifier: 50 Ohm vswr <2:1
Sensitivity: 1mV 30MHz - 900MHz
Maximum Input: +15dBm, 50 milliwatts
Display: 10 digit LCD with backlight

Operating Time: 8 - 10 hours
Power: 2VDC 1 Amp wall plug adapter for rapid charging. 6VDC 130mA minimum operating power required. AC90 adapter supplied.

•Using the optional SAC8000 is a snap-Just plug and play. SAC8000 includes cable, back panel with slot, and velcro attachments.

SAC8000
\$35

Factory Direct Order Line: 1-800-327-5912

MADE
IN
USA

OPTOELECTRONICS®

5821 NE 14th Avenue • Ft. Lauderdale, FL 33334

Visa, MasterCard, C.O.D. Prices and Specifications are subject to change without notice or obligation. All specials are subject to change without notice or obligation.

Internet: <http://www.optoelectronics.com>

Tel: 954•771•2050

Fax: 954•771•2052

BASIC STAMP® COMPUTERS

Tiny computers run BASIC programs

BASIC Stamps are perfect for many applications, from controlling model trains to monitoring factory sensors. They have 8 or 16 I/O lines, which can be used for a variety of digital and analog purposes. And to keep life simple, they're programmed in BASIC. Our special "PBASIC" language includes familiar instructions, such as GOTO, FOR...NEXT, and IF...THEN, as well as instructions for serial I/O, button debounce, DTMF tone generation, etc.

The BASIC Stamp Programming Package contains everything you need to program Stamps using your PC. The package includes our editor software, programming cables, manuals, application notes, and free technical support. The package is available for \$99; Stamps and carrier boards must be purchased separately.

Also available at
Digi-Key
(800-344-4539)
and
Jameco
(800-831-4242)



XOUT *

Generates standard X-10 powerline control signals using two I/O pins and an inexpensive TTL-to-AC convertor module. Signals are received by small modules that control lights and appliances. Receiver modules are available from Parallax, Radio Shack, and other convenient sources.



BS2-IC Module
(FaxBack #6002)

* Only available on the Stamp II.

SHIFTOUT *

Uses two pins to control common shift registers. Can be used as a means of controlling many devices without using too many pins.

74HC595

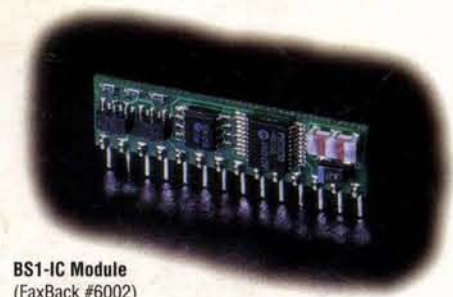
OUT1	1	16	VCC
OUT2	2	15	OUT0
OUT3	3	14	SERIN
OUT4	4	13	OE
OUT5	5	12	RCLK
OUT6	6	11	SCLK
OUT7	7	10	SCLR
GND	8	9	OUT7

BASIC Stamp II Module (BS2-IC)

16 general-purpose I/O lines
2048-byte program space (600 instructions)
\$49, \$69 with optional carrier board

BASIC Stamp I Module (BS1-IC)

8 general-purpose I/O lines
256-byte program space (80 instr.)
\$34, \$49 with optional carrier board



BS1-IC Module
(FaxBack #6002)




DTMFOUT *

Generates DTMF tones with just one I/O pin. Another related instruction, **FREQOUT**, generates one or two tones simultaneously. Each tone is programmable from 0-32767 Hz.



Marvin Green (first row, 2nd from left) uses BASIC Stamps in his Explorer Scouts robotics classes in Hillsboro, Oregon. These are some of his students with their Explorer-Bots, which are small Stamp-based robots that follow a light source while playing a tune.

PARALLAX 

3805 Atherton Road, #102 • Rocklin, CA 95765 • USA • (916) 624-8333 • Fax: 624-8003 • FaxBack: 624-1869 (document #1000 is index) • BBS: 624-7101
E-mail: info@parallaxinc.com • Ftp: ftp.parallaxinc.com • World-wide-web: http://www.parallaxinc.com

Australia +61 3 720 5344 (PICs), +61 67 722 777 (Stamps) • Austria +49 241 918 900 • Belgium +32 41 77 51 51 • Bulgaria +359 2 72 77 50 • Brazil +55 11 453 5588 • Canada (514) 336-9426 • Czech Republic +42 49 5813 252 • Estonia +372 6 397 123 • Finland +358 31 266 1885 • France +33 20 52 98 52 • Germany +49 241 918 900 • Greece +30 1 902 0115 • Hong Kong +852 2720 0255 • Hungary +36 1163 2879 • India +91 422 232 561 • Ireland +44 1 977 683 665 • Israel +972 3 498 543 • Japan +81 3 3251 1779 • Netherlands +31 1803 17666 • New Zealand +61 3 720 5344 (PICs), +61 67 722 777 (Stamps) • Poland +48 34 648 882 • Slovak Republic +42 7 580 2574 • South Africa +27 11 493 6242 • Sweden +46 705 76 14 54, +46 431 41 00 88 • Switzerland +49 241 918 900 • Taiwan +886 2 647 1978 • United Kingdom +44 1 977 683 665 • United States (800) 344-4539 (Digi-Key), (800) 831-4242 (Jameco)

BASIC Stamp & the Parallax logo are registered trademarks of Parallax, Inc. • Prices do not include shipping and applicable sales tax • Features and prices subject to change without notice. • Prices are U.S. prices only; prices in other countries may vary. 0196NVSL

Write in 94 on Reader Service Card.

NUTS & VOLTS MAGAZINE
430 PRINCELAND COURT
CORONA, CA 91719

ADDRESS CORRECTION REQUESTED

BULK RATE
U.S. POSTAGE
PAID
V.Q.S.
ENTERPRISES